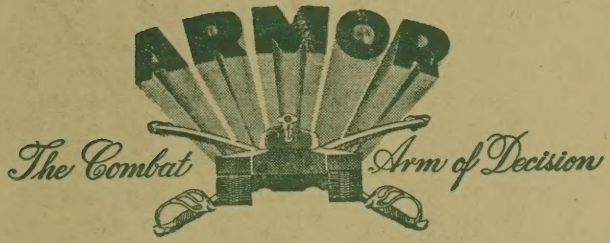
ST 24-18-1

US ARMY

ARMOR COMMUNICATIONS-ELECTRONICS DATA



US ARMY ARMOR SCHOOL
FORT KNOX, KENTUCKY
JULY 1973

INTRODUCTION

The purpose of this special text is to provide a communications-electronics handbook for students and instructors of the United States Army Armor School, as well as training managers, commanders and staffs of active Army and Reserve Component: Armor, Cavalry, and Mechanized units. It reflects the current thought of this School and conforms to published Department of the Army doctrine as closely as possible. The primary focus of content and data is the H-series TOE's.

Comments or recommendations concerning this special text should be forwarded to the Commandant, United States Army Armor School, ATTN: ATSB-CE, Fort Knox, Kentucky, 40121.

ARMOR COMMUNICATIONS-ELECTRONICS DATA

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*This special text supersedes ST 24-18-1, September 1971.

CHAPTER 1

COMMUNICATIONS DOCTRINE

1-1. GENERAL

The ability of armor units to move and shoot depends, to a large extent, on their ability to effectively communicate. The armor unit commander must rely on communications to control the elements of his command, gather information, distribute intelligence, and coordinate firepower. The preparation for every operation must include communications planning.

1-2. COMMUNICATIONS RESPONSIBILITIES

The commander is personally responsible for the adequacy and proper use of the communications system within his command and for its efficient operation in the system of the next higher headquarters. The authority to establish, maintain, control, and coordinate the employment of the various means of communications within a command may be exercised by a subordinate in the name of the commander. However, the responsibility for these means cannot be delegated. The armor commander's communications responsibilities include the areas of planning, maintenance, and training.

a. Senior to Subordinate. The commander of a higher echelon or superior unit is responsible for the establishment of communications to a lower echelon or to a subordinate unit. An attached unit is considered subordinate to the command to which it is attached with respect to placing the responsibility for communications.

b. Supporting to Supported. The commander of a supporting unit is responsible for the establishment of communications to the supported unit.

c. Reinforcing to Reinforced. A unit having a reinforcing mission is responsible for the establishment of communications to the unit being reinforced.

d. Lateral Communications. Responsibility for the establishment of communications between adjacent units may be fixed by the next higher commander or may be established in the SOP. In the absence of specific orders fixing this responsibility, the commander of the unit on the left is responsible for establishing communications with the unit on the right.

e. Restoration. Both commanders are responsible for taking immediate and aggressive action to restore disrupted communications between their units.

1-3. TACTICAL COMMUNICATIONS MEANS

a. Selection. The communications means available to armor unit commanders are radio, wire, visual, and sound, which are classified as telecommunications; and messenger, which is a physical communications means. The composition of the means in each unit depends on the personnel, equipment, and transportation provided by its table of organization and equipment and by the unit or higher echelon commander. The various means of communications have different capabilities and limitations; consequently, they are so employed that they complement each other to ensure that total dependence is not placed upon any one means. Certain means of communications are more effective than others under given circumstances. Selection of the most appropriate means is made by weighing such factors as operational urgency, installation time, transmission time, susceptibility to enemy action, reliability, and cost in resources. Command and control is jeopardized as dependence is placed on fewer means and strengthened as reliance is spread to a variety of means.

b. Radio Communications. The most important characteristic of the radio sets used in armor units are shown in chapters 3 through 5. To be capable of operating together, radio sets must have a common or overlapping frequency range, use the same type of modulation, and transmit and receive the same type of signal. In addition, the stronger set must be kept

within the transmitting range of the weaker set. The operating ranges shown in this text are for average conditions. The actual ranges obtained may be greater or less, depending on the skill of the operators, weather, terrain, interference, and the locations from which the sets are operated. Power lines and steel structures close to a radio site reduce operating range. Radio communications are subject to natural interference (primarily AM radios), interference from other radio stations, and deliberate interference (jamming) by unfriendly forces. The reliability of radio communications depends largely on the skill of the operators.

c. Wire Communications. Wire communications generally affords more security than radio. However, the security of classified information is never assured when transmitted in the clear. The decision to establish wire communications depends on the need, time available, and the capability to install and maintain the wire systems. Detailed information about the wire equipment employed by armor units is contained in chapter 8.

d. Visual, Sound, and Messenger Communications. Visual communications are widely used within armor units. The equipment needed is simple and readily available in most situations. Emergency sound signals are used by all units. The use of messenger service becomes more significant at battalion and higher echelons. Details concerning visual, sound, and messenger communications are contained in chapter 9.

1-4. COMMUNICATIONS CHARACTERISTICS

The more important characteristics of a communications system are reliability, flexibility, speed, security, and economy.

a. Compatibility. Although all of the communications system characteristics are interrelated, they are not necessarily completely compatible. Emphasis placed on one characteristic may degrade another. For example, the importance of speed may outweigh the need for security. Generally, a carefully applied balance of all the characteristics will provide an effective and efficient communications system. Emphasis placed on any one characteristic, such as the necessity for speed, will vary with the mission of the unit, the tactical situation, and the commander's judgement.

b. Reliability and Flexibility. Reliability is the probability of a communications system performing adequately in support of the tactical mission under the expected operating conditions. It is achieved by using more than one means of communications, providing alternate routes, and maintaining a reserve of equipment. Overemphasis on economy or overcommitment of communications resources will seriously impair reliability and flexibility. A flexible communications system can readily adjust to changes in missions and tactical situations.

c. Speed and Security. Maximum communications security is obtained by employing every safeguard consistent with operational requirements. Effective security depends on a proper balance between security controls and operational urgency. Strict security must be observed at all times in static situations. In fluid combat situations, a relaxation of security may be necessary because of operational conditions. While engaged in combat operations, the local commander may authorize transmission in the clear (plain text form); however, this action should be taken only when, in the commander's judgement, a time delay to encrypt would jeopardize his command and the information to be transmitted would not afford the enemy a tactical advantage. The commander does not permit relaxation of security measures where such action may result in the compromise of the plans of a higher commander or of a cryptographic system outside his immediate command. The use of a message precedence system and the establishment of user priorities will improve communications speed.

d. Economy. The means of communications in any command exist for the primary and exclusive use of the commander and such personnel as he may designate. The use of these means is kept to the minimum consistent with the mission or objectives of the commander. One of the primary ways of ensuring communications economy is to place emphasis on the restricted use of communications systems. The application of this characteristic is

not intended to encourage a conservative attitude toward the full employment of the means available, but to discourage their use for purposes other than those for which intended. These means are provided as a tool for the commander and his staff, not as a personal convenience.

1-5. COMMUNICATIONS IN TACTICAL OPERATIONS

a. Coordination. The type or means of communications employed in a tactical operation depends on the type of operation, the tactical situation, and the means available. Coordination of tactical communications, electronic warfare (EW), and other communications-electronics functions is essential to the success of tactical operations.

b. Command Post Location. The command post of the unit controlling the operation should be located to facilitate communications. An improperly located command post may delay the establishment of communications at a critical time or make maintenance of effective communications impossible. The principal considerations for the command post location with respect to communications include:

(1) Effects of distance and terrain on wire and messenger communications.

(2) Necessity for wire routes to the front and rear permitting the prompt establishment of wire communications when possible.

(3) Effect of power lines, electrical stations, hill masses, dense woods, and distance on radio communications.

(4) Proximity to suitable terrain for a helipad or airfield to facilitate messenger service.

(5) Necessity for line-of-site locations visible only to friendly troops for use of visual and some types of radio communications.

(6) Routes of communications and traffic conditions. Since all communications facilities focus at the command post, roads into and out of it and the traffic to be expected on these roads influence its location. Messengers, wire teams, and command vehicles constantly use the routes of communications from the command post to subordinate and higher units. The absence of suitable communication routes causes delays and makes tactical control difficult.

CHAPTER 2

PRINCIPLES OF RADIO COMMUNICATIONS

2-1. GENERAL

Radio is the primary means of communications within and between armor units. It provides a flexible link between the armor commander and the mobile elements of his command. The extensive use of radio in armor organizations makes it necessary for all armor personnel to have a general understanding of the capabilities, limitations, and peculiarities of radio communications.

2-2. RADIO WAVE PROPAGATION

Radio signals travel from the transmitter to the receiver as electromagnetic waves. These waves move at the speed of light. Their rapid speed provides instant point-to-point communications. These electromagnetic waves, called radio waves, are grouped in eight bands according to frequency.

a. Their classification is as follows:

BAND	FREQUENCY
Very low frequency (VLF)	3-30 Kilohertz
Low frequency (LF)	30-300 kHz
Medium frequency (MF)	300-3,000 kHz
High frequency (HF)	3-30 Megahertz
Very high frequency (VHF)	30-300 MHz
Ultrahigh frequency (UHF)	300-3,000 MHz
Superhigh frequency (SHF)	3-30 Gigahertz
Extremely high frequency (EHF)	30-40 GHz

b. There are two principal paths by which radio waves can travel from a transmitter to a receiver. One is by ground waves (fig 2-1), which travel directly from the transmitter to the receiver. The other is by sky waves, which travel up to the ionosphere and are bent downward, or refracted, back to the earth. Long distance radio transmission is achieved principally by the use of sky waves. Short distance and most UHF and upper VHF transmissions are by means of ground waves. Some forms of transmission make use of combinations of both paths. Radio waves in the VHF band and higher frequencies may be transmitted by atmospheric or ionospheric scattering. This mode of transmission is normally limited to long range, high-powered radios.

c. Ground wave propagation refers to those types of radio transmissions that do not make use of waves that have been refracted from the ionosphere. The strength of ground waves depends on several factors, including: the transmitter power, the characteristics of the transmitting antenna, the frequency of the waves, the diffraction of the waves around the curvature of the earth, and local weather conditions. The following are the principal components of a ground wave:

(1) Direct (line-of-site) wave. The direct wave is that component of the wave front that travels directly from the transmitting antenna to the receiving antenna. This component is limited to the line-of-site distance between the transmitting and receiving antennas, plus the small distance added by atmospheric refraction and diffraction of the wave around the curvature of the earth. This distance can be extended by increasing the height of either the transmitting or receiving antenna (or both).

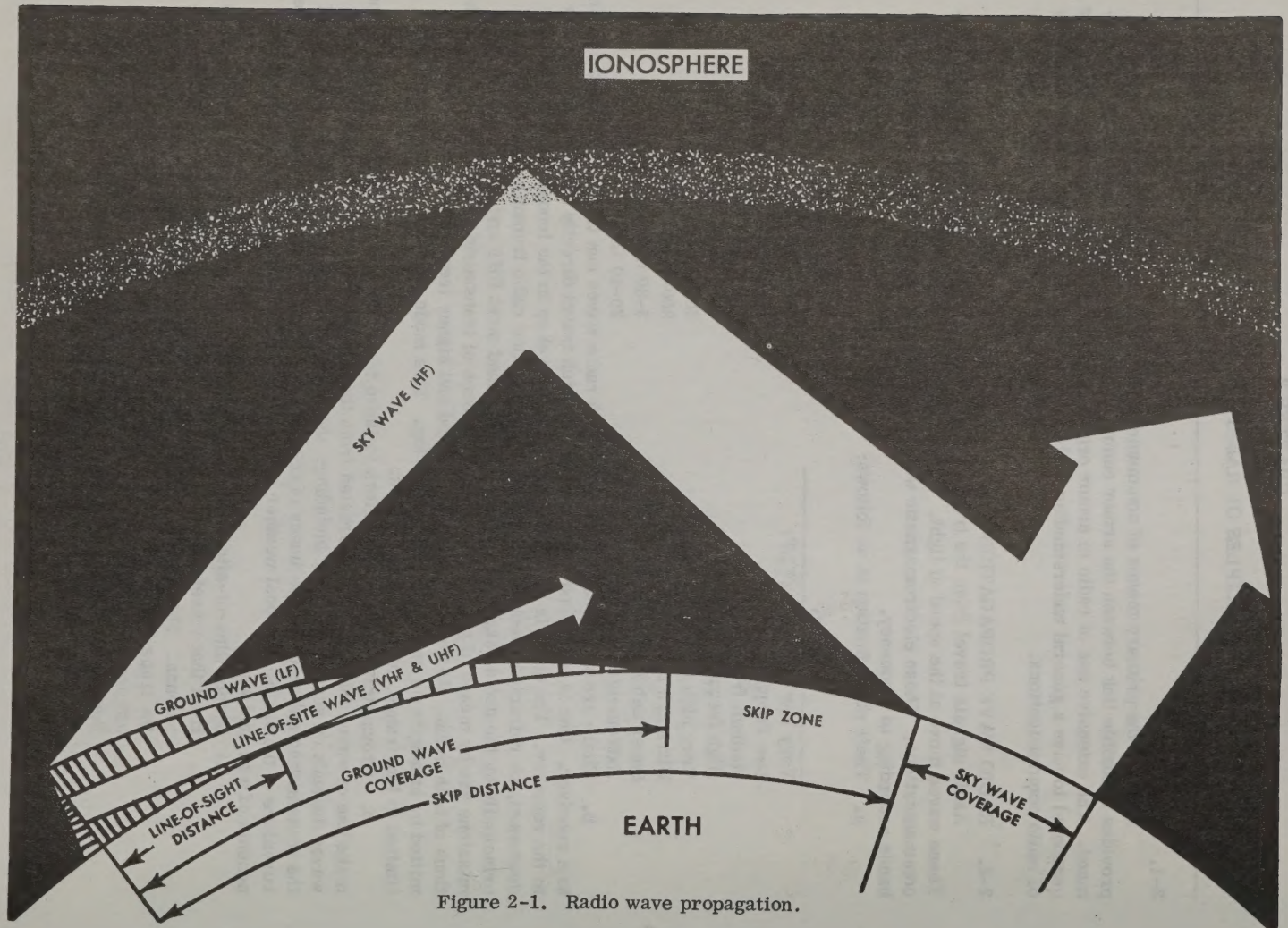


Figure 2-1. Radio wave propagation.

(2) Surface wave. The surface wave follows the curvature of the earth. These waves may be compared to large sea waves breaking on shore. The distance they travel up the beach depends on the strength of the wave and the steepness of the shoreline.

d. Surface wave propagation is the most dependable under all atmospheric conditions. At low frequencies, the surface wave extends for a considerable distance, but this distance decreases rapidly as the frequency is increased, so that any frequency above the MF band has a very limited surface wave transmission range.

e. Figure 2-1 also shows the direct (line-of-site) wave propagation. In the VHF band and higher frequencies, it is the only practical means of obtaining reliable communications with low or medium power. Natural or man-made obstacles in the line-of-site path between the transmitting antenna and the receiving antenna will hinder transmissions.

f. The type of propagation used for long range communications is also shown in figure 2-1. This type of propagation is known as sky wave. Sky wave propagation over great distances is made possible by the existence of ionized layers in the upper atmosphere. These layers act as a refractor to certain bands of frequencies and will cause part of the signal to bend back toward the earth and thereby be made available for reception at points beyond the horizon. Several "skips" may allow the signal to be received at distances of thousands of miles from the transmitter. The ionized layers are continually varying in contour and height, so that fading effects are experienced at the distant reception points. Also, the layers rise in daylight and descend at night, so that the skip distance changes from day to night. By using higher frequencies during daylight and lower frequencies at night, communication with a distant point may be maintained with considerable reliability. Frequencies in the HF band are used for this type of long distance communications.

2-3. RADIO FREQUENCY UTILIZATION

a. Radio frequencies are a limited resource that must be shared by civil, government, and military users in both peace and war, and only some of these frequencies are available for each user. The internationally recognized, and hence controlled, radio frequency spectrum extends from 3 kHz to 40 GHz. Since the propagation characteristics of radio waves vary in different parts of the spectrum, not all frequencies are equally useful for the same purpose.

b. Parts of the spectrum are in such great demand that it is virtually impossible to obtain frequencies for newly developed equipment without sacrificing existing communications channels. Competition is intense for frequencies suitable for long range communications and only international control permits operation within tolerable interference levels. The actual number of separate and distinct channels of communication available within any frequency band is constantly changing, and increasing with improvements in equipment, operating techniques, propagation prediction data, and the effectiveness of radio frequency management. The demand for radio frequencies has increased at a pace that exceeds their expanding use. New equipments and systems are constantly being developed that increase further the demand for frequencies.

c. Detailed management is necessary in order to obtain maximum use of available frequencies. FM 24-2 and ACP 190 provide instruction, guidance, and technical information concerning the organization and responsibilities for frequency allocation and assignment.

2-4. THE RADIO TRANSMITTER

The transmitter generates, modulates, and radiates radio waves. A voice transmitter consists of a radio frequency generator (called an oscillator), a power amplifier for increasing its power to the desired level, a modulator for superimposing (modulating) the signal onto the radio carrier wave, and an antenna for radiating the modulated carrier. When a carrier is modulated, upper and lower sidebands are formed. Since the transmitted wave

consists of the carrier and sidebands, it covers a band of frequencies. The bandwidth for amplitude modulation is about 10 kilohertz. The bandwidth for frequency modulation is determined by the amplitude of the signal.

2-5. THE RADIO RECEIVER

Radio waves passing an antenna generate small electrical currents in the antenna that correspond in both frequency and amplitude variation to the radio waves that generated them. As these currents enter the receiver a series of amplifiers, each with selective circuits, picks out the frequency corresponding to the carrier wave from a desired station, and amplifies it until it becomes fairly strong. This carrier wave still contains the variations corresponding to the input signal, either in the form of frequency or amplitude modulation. A demodulator is used to separate the signal from the carrier. The signal is then further amplified and made to operate a loudspeaker or earphone.

2-6. ADVANTAGES OF RADIO

a. Radio communication factilities can generally be installed rapidly. Portable and vehicular-mounted radios may be made operational in a matter of seconds.

b. Radio is a flexible means of communications. Stations may be added to or deleted from a radio net as required. Communications by radio can be maintained while troops are mobile. It may be integrated with wire, used from ground-to-air or air-to-air, and remotely operated. It provides communications across terrain over which it may be impractical to install wire.

2-7. LIMITATIONS OF RADIO

a. Radio, without speech security devices, is the least secure means of communications. It must be assumed that interception takes place every time a transmitter is operated.

b. Radio communications is subject to interference from atmospheric conditions and other electronic devices and is relatively easy to jam.

2-8. PRINCIPAL CHARACTERISTICS OF RADIO SETS

There are several characteristics that apply to all radio sets. These characteristics outline the capabilities and limitations of radio equipment. The six principal characteristics of radio sets are:

a. Type of Set.

(1) Portable sets. Those that can be carried by an individual and can be operated while being moved.

(2) Transportable sets. Those that can be moved from one location to another, normally by a team of men; however, they cannot be operated while being moved.

(3) Vehicular sets. Those normally installed in a vehicle obtaining their power from the vehicle electrical system.

(4) General use. Those radios that may be vehicular mounted or employed in a portable or transportable mode.

b. Type of Modulation. Modulation is the process used to vary the characteristics of the radio wave to represent a desired input signal. Although there are several types of modulation, the two commonly used in tactical voice radio sets are frequency modulation (commonly known as FM) and amplitude modulation (commonly known as AM). FM is the process of varying the frequency of a radio carrier wave in accordance with the amplitude and frequency of the transmitted signal. In AM, the process varies the amplitude of the radio carrier wave.

(1) Because of technical differences, two radios sets cannot net unless both sets have the same type modulation.

(2) A principal advantage of FM is that it is less subject to static or atmospheric disturbances. The principal advantage of AM is its comparatively narrow band operation that provides more operating channels within a given frequency coverage.

c. Type of Emission.

(1) Voice. Most tactical radio sets are capable of voice emission.

(2) Continuous wave (CW) and modulated continuous wave (MCW). These are used to transmit international Morse code by means of a key.

(3) Frequency shift keying (FSK). Commonly known as radioteletype.

(4) Tone.

(5) Narrow frequency shift keying (NSK).

d. Frequency Coverage. The lowest to highest radio operating frequencies (para (para 2-2a).

e. Operating Range. The rated range of the radio sets are planning figures. This is the range over which we can normally expect to communicate with a high degree of reliability.

f. Power Sources.

(1) Dry cell batteries.

(2) Vehicular power systems.

(3) Hand generators.

(4) Gas engine generators.

(5) Wet cell batteries.

CHAPTER 3

FREQUENCY MODULATED (FM) RADIO EQUIPMENT

3-1. GENERAL

Most of the current, low echelon tactical radio sets are frequency modulated (FM). The principal advantage of FM over amplitude (AM) modulation is its high degree of operational reliability. In an AM set random noise and other types of electromagnetic interference have considerable disrupting effect because they have the same characteristics as the transmitted signal. This is not the case for FM signals. The fundamental principles and theory of FM radio communications are contained in TM 11-668. The vehicular configurations of the AN/VRC-12 and AN/PRC-77 series radios are not operational without the mountings, control boxes, cables, and audio accessories contained in the specific installation kits. These kits are listed in SB 11-131, Vehicular Radio Sets and Authorized Installations. Track vehicles have electrical equipment harnesses installed as part of the vehicle. The installation kits and equipment harnesses, together, provide for a complete operating radio system. Power Supply PP-2953(*)/U (para 3-5) can be used to provide the power for nonvehicular installations of the AN/VRC-12 and AN/PRC-77 series radios.

3-2. AN/VRC-12 SERIES RADIOS (TM 11-5820-401-12) (Fig 3-1)

a. General. The AN/VRC-12 series radios provide short range, two-way voice communications from vehicles, light aircraft, small marine craft, and communications shelter. They can be operated alone or in conjunction with intercommunication equipment. The whip antenna for the Receiver, Radio R-442(*)/VRC is a part of the installation kit.

b. Utilization. Retransmission capability is provided by Retransmission Cable Kit MK-456A/GRC (para 3-6). Secure voice operation is provided by Speech Security Equipment TSEC/KY-8. Extended operating range is provided by Antenna Equipment RC-292 (para 7-5). Homing capability is provided by Antenna Loop AT-784/PRC (para 7-10). Electrical Transient Suppressor MX-778/GRC (para 3-8) provides protection for the radio/radio-intercommunication system from voltage surges in the vehicular electrical system.

c. Receiver-Transmitter, Radio RT-246(*)/VRC (fig 3-2) and RT-524(*)/VRC (fig 3-3).

(1) General. Each of these receiver-transmitters use Mounting MT-1029/VRC. (Part of the electrical equipment harness in track vehicles.) The mounting has a connection that provides for the passage of dc power and audio and control signals between the receiver-transmitter and the associated intercommunication system. Internal circuitry on the A models are slightly different and they do not have front handle assemblies (only front guards). The RT-246 has an automatic tuning capability for 10 preset channels. This automatic tuning can be controlled from a Control, Frequency Selector C-2742/VRC (para 3-9b), or directly from the radio set. The RT-524 has only manual tuning. The RT-524 has a loudspeaker built in the front panel which the RT-246 does not have. Both use Antenna AS-1729/VRC. (Para 7-3.)

(2) Technical characteristics.

(a) Frequency range: 30.00-75.95 MHz.
(b) Number of channels: 920.
(c) Channel spacing: 50 kHz.
(d) Number of presets: RT-246 only 10.
(e) Operating range: 10 miles (16 km) low power, 30 miles (48 km) high power.
(f) Power output: 8-10 watts low power, 35 watts high power.
(g) Power requirement: 22-30 volts dc; 75 watts low power, 250 watts high power.

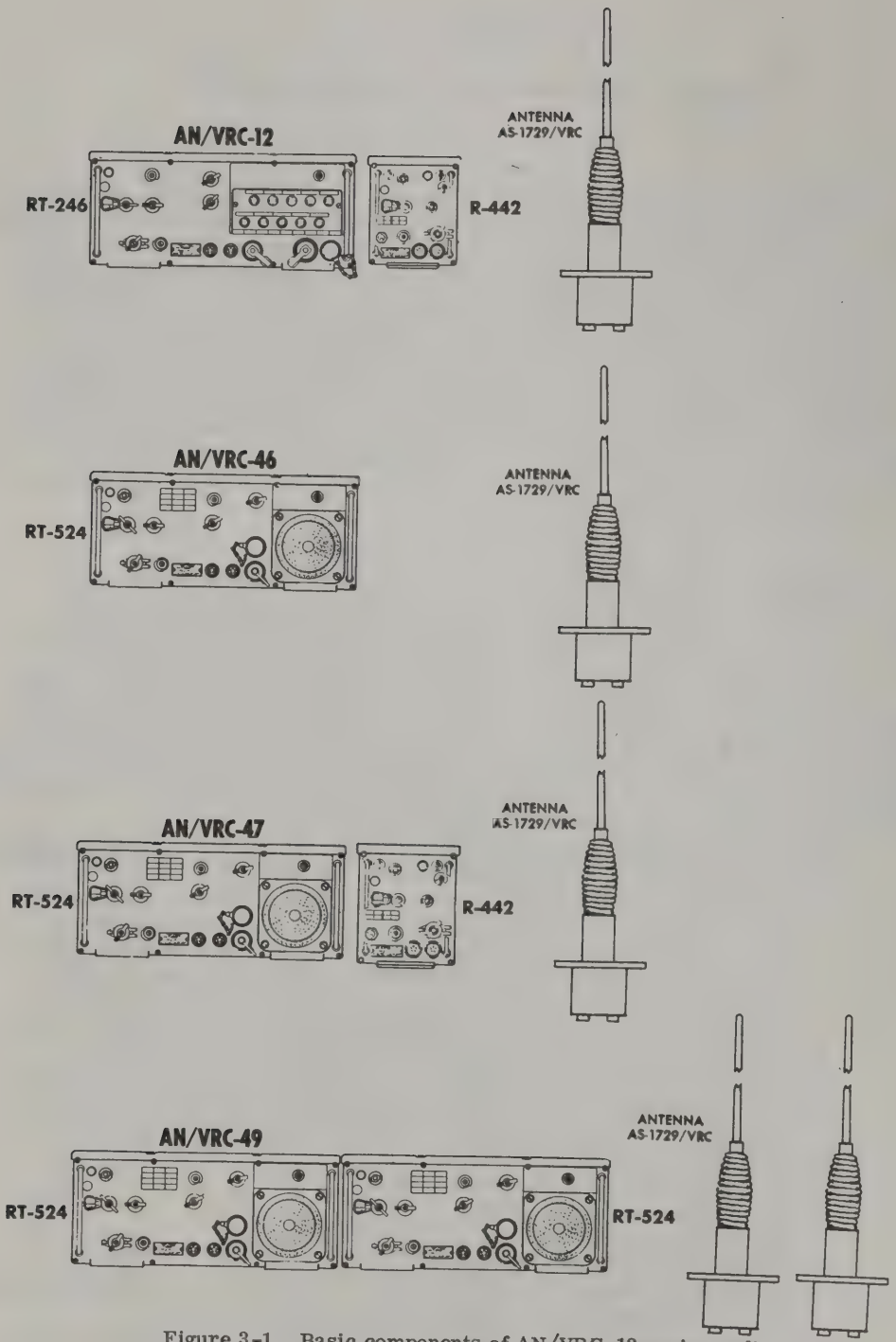


Figure 3-1. Basic components of AN/VRC-12 series radio sets used in armor units.

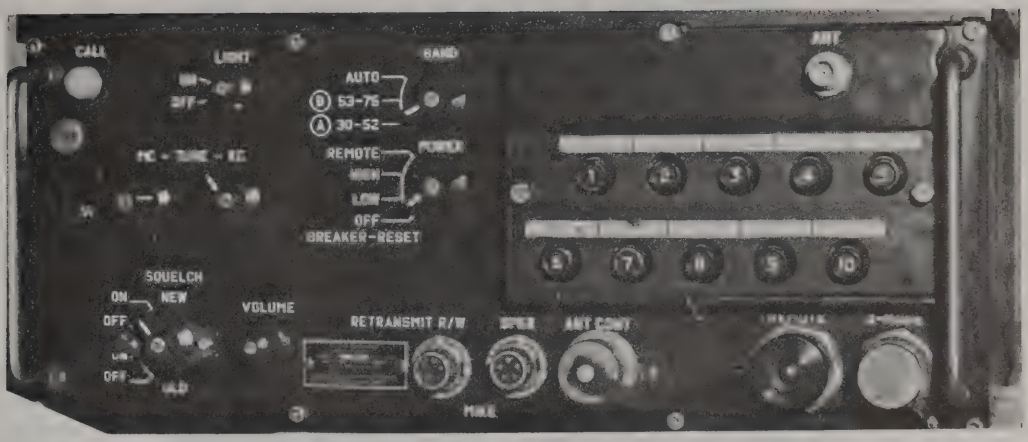


Figure 3-2. Receiver-Transmitter, Radio RT-246(*)/VRC.

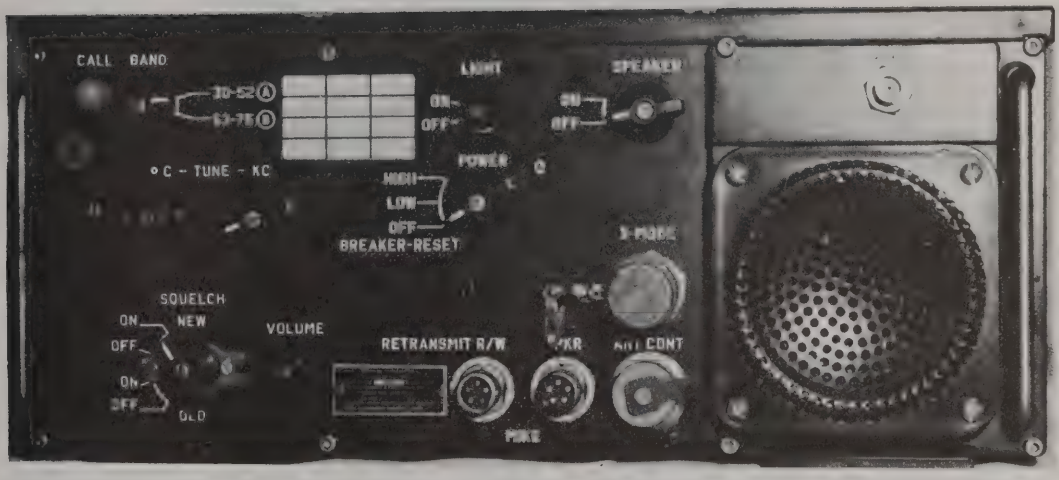


Figure 3-3. Receiver-Transmitter, Radio RT-524(*)/VRC.

(h) Squelch: Noise or 150-Hz tone operated, or none.

(i) Weight: RT-246--56.25 pounds, RT-524--51.00 pounds, Mounting--17.50 pounds.

d. Receiver, Radio R-442/VRC (fig 3-4).

(1) General. This receiver provides a monitoring capability. It is common practice for armor unit commanders to tune the receiver-transmitter to his own command net and monitor the command net of the next higher headquarters with the R-442. It serves as an auxiliary receiver. As with the receiver-transmitters, the only differences in models are minor internal circuitry changes and lack of handle assemblies on the A models. The R-442

Figure 3-4. Receiver, Radio R-442/VRC.

uses Mounting MT-1898/VRC, part of the electrical equipment harness in track vehicles, to provide for passage of dc power and audio signals between the receiver and the associated intercommunication equipment. The R-442 uses a three-section whip antenna (Mast Base AB-558/GR, bottom MS-116A, middle MS-117A, top MS-118A).

(2) Technical characteristics.
- (a) Frequency range: 30.00-75.95 MHz.
- (b) Number of channels: 920.
- (c) Channel spacing: 50 kHz.
- (d) Power requirement: 22-30 volts dc, 18.8 watts.
- (e) Squelch: Noise or 150-Hz tone operated, or none.
- (f) Weight: 18.25 pounds.

3-3. AN/PRC-77 SERIES RADIOS (TM 11-5820-667-12 and TM 11-5820-498-12) (Fig 3-5)

a. General. The AN/PRC-77 series radios provide short range, two-way voice communications in manpack portable and vehicular configurations. They are the replacements for the AN/PRC-25 series radios. The vehicular configurations can be operated alone or in conjunction with intercommunications equipment. The basic reference manuals are: AN/PRC-77, TM 11-5820-667-12; AN/VRC-64 and AN/GRC-160, TM 11-5820-498-12.

b. Utilization. Retransmission capability is provided by Retransmission Cable Kit MK-456A/GRC (para 3-6). Remote operation is provided by Radio Set Control Group AN/GRA-39(*) (para 3-7), or Radio Set Control Group AN/GRA-6 when used with Cable Assembly, Special Purpose, Electrical CX-7474/U (para 4-6). Secure voice operation is provided by Speech Security Equipment TSEC/KY-38. Extended operating range is provided by Antenna

	AN/PRC-77	AN/VRC-64	AN/GRC-160
RT-841	1	1	1
AS-1729		1	1
AT-892	1		1
AT-271A	1		1
AB-591	1		1
ST-138	1		1
CW-503	1		1
H-189	1		1
OA-3633(*)/GRC		1	1

Figure 3-5. Basic components of the AN/PRC-77 series radios.

Equipment RC-292 (para 7-5) or long wire Antenna AT-984A/G (para 7-9). Homing capability is provided by Antenna Loop AT-784/PRC (para 7-10). Electrical Transient Suppressor MX-778/GRC (para 3-8) provides protection of the radio/radio-intercommunication system from voltage surges in the vehicular electrical system. Loudspeaker, Electromagnetic LS-549/PRC (para 3-10h) can be used for monitoring radio reception.

c. Receiver-Transmitter, Radio RT-841/PRC-77 (fig 3-6).

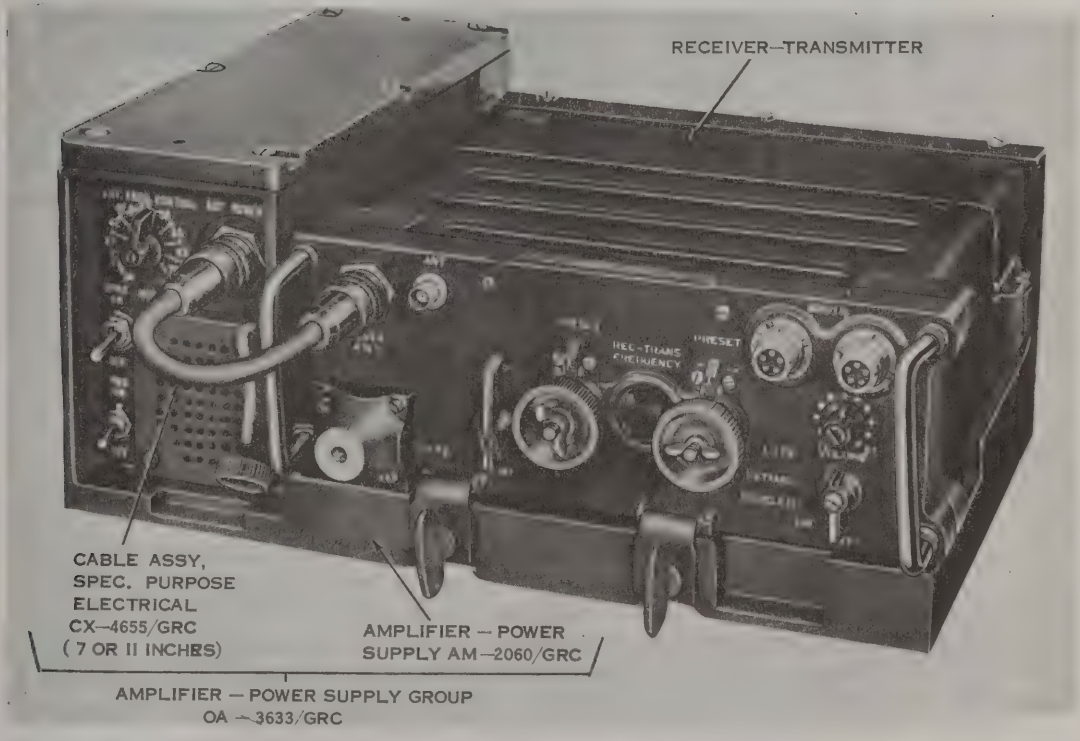

RECEIVER—TRANSMITTER
CABLE ASSY, SPEC. PURPOSE ELECTRICAL CX—4655/GRC (7 OR 11 INCHES)
AMPLIFIER — POWER SUPPLY AM—2060/GRC
AMPLIFIER — POWER SUPPLY GROUP OA—3633/GRC

Figure 3-6. Receiver-Transmitter, Radio RT-841/PRC-77 and Amplifier, Power Supply Group OA-3633/GRC or OA-3633A/GRC with receiver-transmitter installed.

(1) General. The RT-841 receiver-transmitter is housed in a watertight case with an attached Battery Box CY-2562/PRC-25.

(2) Technical characteristics.

(a) Frequency range: Low band--30.00-52.95 MHz. High band 53.00-75.95 MHz.

(b) Number of channels: 920.

(c) Channel spacing: 50 kHz.

(d) Number of presets: 2.

(e) Operating range: 3 miles (4.8 km) with AT-892/PRC-25, 5 miles (8 km) with AT-271A/PRC, 12 miles (19.2 km) with RC-292, 17 miles (28.0 km) with AT-984/G.

(f) Power output: 1.5-4.0 watts; 12.5-15 volts dc, 11.7 watts.

(g) Power requirement: Battery operated BA-386/PRC-25, BA-4386/U or BA-398/U (Arctic). Nominal battery life 30 hours with BA-386/PRC-25 and 60 hours with BA-4386/U. Vehicular, 24 volt dc.

(h) Squelch: Noise and 150-Hz tone operated.

(i) Weight: 13 pounds (without battery).

d. Antennas. Vehicular configurations use Antenna AS-1729/VRC (para 7-3). For dismounted operation, either the Antenna AT-892/PRC-25 or Antenna AT-271A/PRC can be used.

(1) Antenna AT-892/PRC-25 (fig 3-7).

Figure 3-7. Antenna AT-892/PRC-25.

The AT-892/PRC-25 is a 1-section, 3-foot, whip antenna. A spring at its base allows the antenna to be placed in a vertical position no matter what the position of the receiver-transmitter. It is constructed of steel tape and can be folded for storage.

(2) Antenna AT-271A/PRC (fig 3-8).

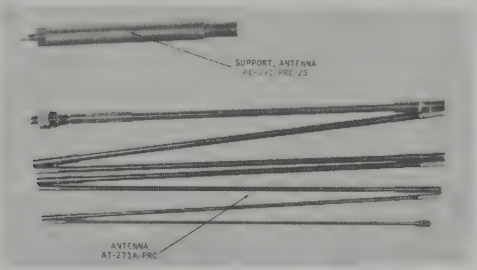


Figure 3-8. Antenna AT-271A/PRC.

The AT-271A/PRC is a 6-section, tubular, folding whip antenna. A stainless steel, plastic-covered cable (or braided plastic cord) under spring tension is threaded through the sections to keep them together when assembled for operation and prevent their separation or loss when disassembled. Spring tension is provided by a spiral spring in the base section. An antenna top cap installed on the tip of the antenna provides protection for personnel. As a base it uses a rigid, tubular support, Antenna AB-591/PRC-25.

e. Harness, Electrical Equipment ST-138/PRC-25 (fig 3-9).

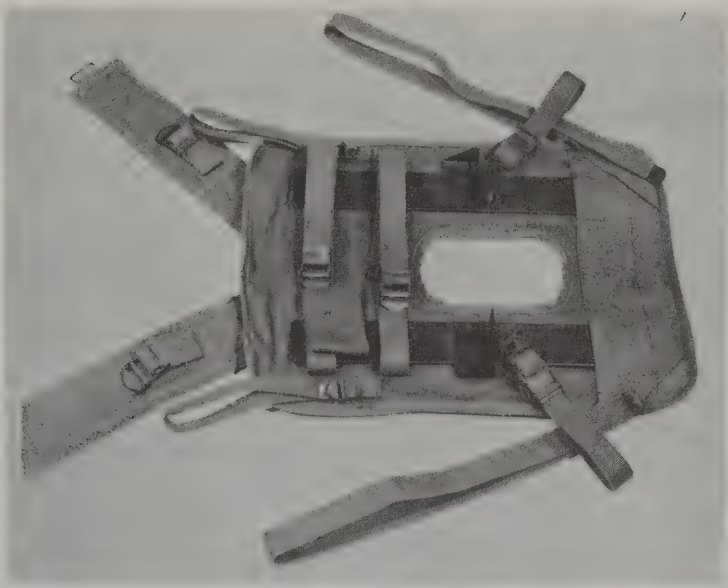


Figure 3-9. Harness, Electrical Equipment ST-138/PRC-25.

The ST-138/PRC-25 harness is a cotton duck back pack. It is used to secure the receiver-transmitter so that it can be carried on the operator's back.

f. Bag, Cotton Duck CW-503/PRC-25 (fig 3-10).

Figure 3-10. Bag, Cotton Duck CW-503/PRC-25.

The CW-503/PRC-25 bag is a sectionalized canvas carrying case used to store the two whip antennas and the handset.

3-4. RECEIVER SET, RADIO AN/PRR-9 (Fig 3-11) AND TRANSMITTER SET, RADIO AN/PRT-4 (Fig 3-12) (TM 11-5820-549-12)

a. General. The AN/PRR-9 receiver and AN/PRT-4 transmitter are employed together to provide one-way voice or audio tone communications. Both the transmitter and receiver have a lanyard, a harness slide, and an integral antenna (AS-1998(*)/PRR-9 flexible, 18-inch, stainless steel whip for the receiver, and AS-1999/PRT-4 collapsible, 24-inch, tubular whip for the transmitter). In addition, the receiver has a Headset, Electrical H-264/PRR-9 that can be worn in the ear to improve reception in noisy areas. Indicator, Channel Alignment ID-1189/PR (d below) is used to align and check both the receiver and transmitter.

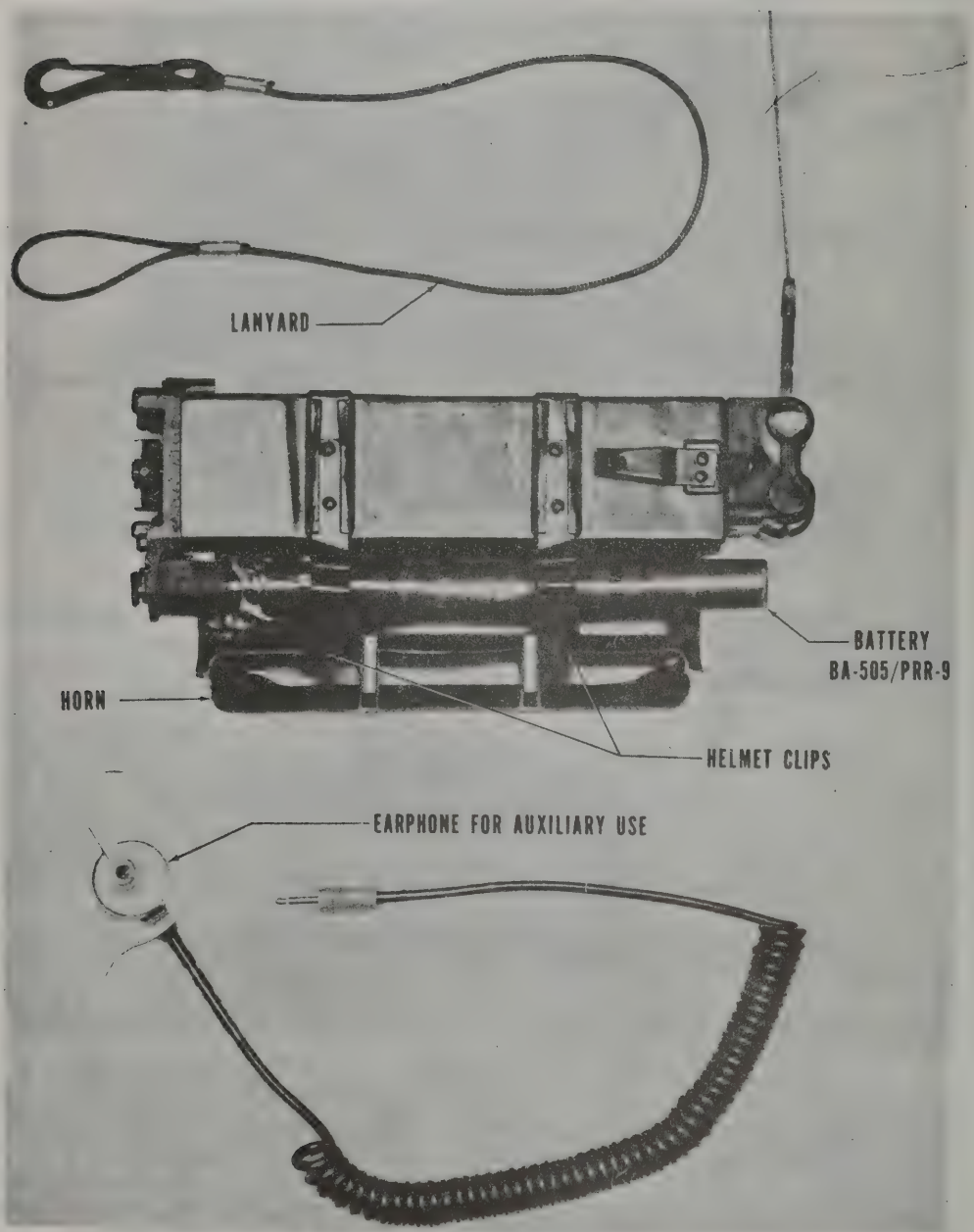


Figure 3-11. Receiver Set, Radio AN/PRR-9.

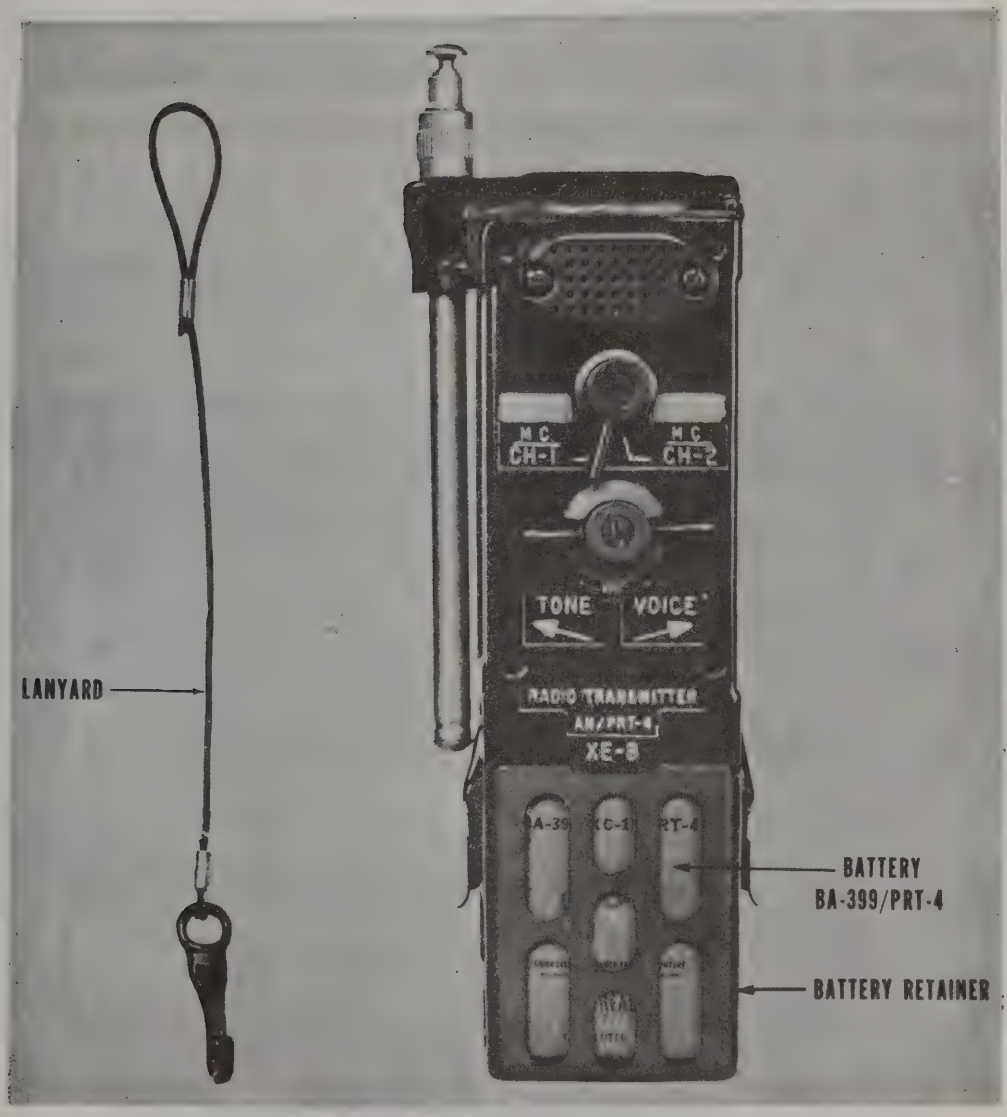


Figure 3-12. Transmitter Set, Radio AN/PRT-4.

b. Utilization. The AN/PRR-9 receiver is designed for quick attachment and use on the standard helmet. It may also be used when carried in a shirt pocket or clipped to a harness. The AN/PRT-4 transmitter is hand-held when operated. When not in use, it may be clipped to a pocket or belt. The lanyards are used to help prevent loss. For arctic operation three additional accessories are used: Harness, Electrical Equipment ST-153/PRR-9, for carrying the receiver over a covered helmet, and two battery extender cables (Cable Assembly, Special Purpose, Electrical CX-11990/PRR-9 and CS-11991/PRT-4) that permit the batteries to be carried inside the operator's clothing.

c. Technical Characteristics.

(1) Frequency range: 47-57 MHz.
(2) Number of channels. Transmitter 2; 110 separate crystals for transmitter and receiver.
(3) Channel spacing: Less than 1.0 MHz for transmitter, 100 kHz between crystals.
(4) Operating range: Channel 1, 1 mile (1.6 km), channel 2, 0.3 mile (0.5 km).
(5) Power output: Channel 1, 450 milliwatts, channel 2, 50-250 milliwatts.
(6) Power requirement: Battery operated: Receiver, BA-505/U; Transmitter, BA-399/U.
(7) Squelch: None, or 150-Hz tone operated.
(8) Weight w/batteries and accessories: Receiver, 10.55 ounces; Transmitter, 17.85 ounces.

d. Indicator, Channel Alignment ID-1189/PR (TM 11-6625-937-12) (Fig 3-13).

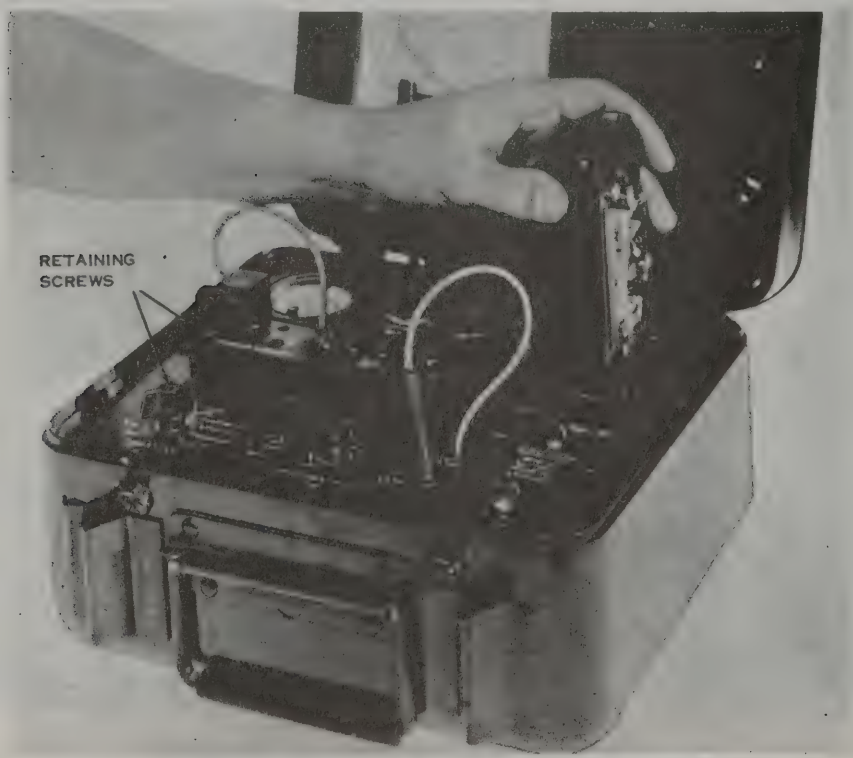


Figure 3-13. Indicator, Channel Alignment ID-1189/PR.

(1) General. The ID-1189/PR is an alignment and battery test instrument used with the AN/PRR-9 receiver and AN/PRT-4 transmitter. In addition to the basic test set, the set includes (inside the cover of the case): a 3/8-inch blade screwdriver, 1/4-inch blade alignment tool, 17-inch whip antenna, and 2 instruction plates.

(2) Utilization. Batteries are placed in receptacles on the face of the test instrument. Their condition is indicated by a green (good)--yellow (marginal)--red (bad) meter scale. The test instrument's internal battery can be tested in the same way. The electronic assemblies of the AN/PRR-9 receiver and AN/PRT-4 transmitter also mount in receptacles so that adjustment and test points are accessible.

(3) Technical characteristics.
   (a) Power requirement: Battery operated, BA-399/U.
   (b) Weight: 14.5 pounds.

3-5. POWER SUPPLY PP-2953(*)/U (TM 11-6130-233-12) (Fig 3-14)

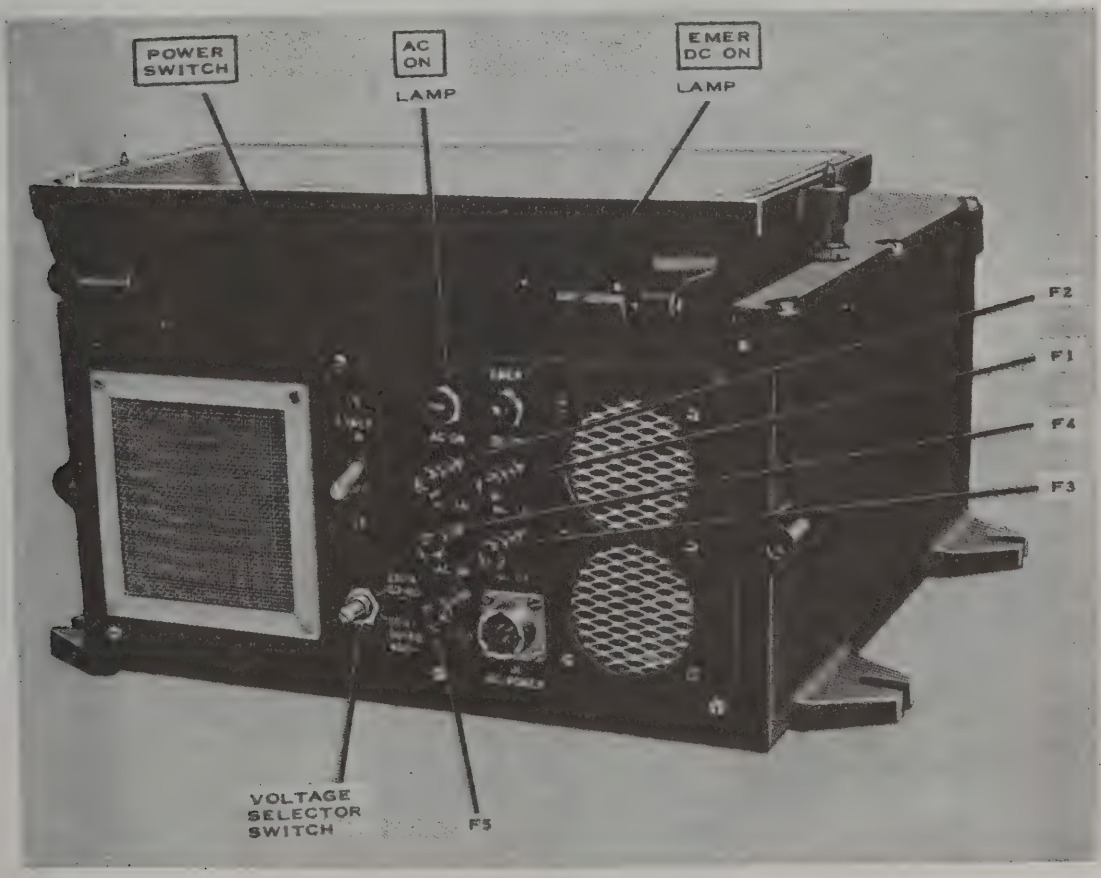


Figure 3-14. Power Supply PP-2953(*)/U.

a. General. The PP-2953(*)/U power supply is used to provide a source of regulated dc power for fixed station operation or bench testing of the AN/VRC-12 and AN/PRC-77 series of radios (two Amplifier, Power Supply Groups OA-3633/GRC may be operated from one PP-2953(*)/U). There is only one component in addition to the main unit, Cable Assembly, Power, Electrical CX-4524/U, a 15-foot ac power cord. All power supply models are basically the same except that the B model uses circuit breakers instead of fuses.

b. Utilization. In addition to the 15-foot power cord, 2 other cables are required that are not components of the power supply: Cable Assembly, Power, Electrical CX-4720/VRC (10-foot) and CX-4721/VRC (3-foot).

c. Technical Characteristics.

(1) Power output: 22.7-27.7 volts dc. 277 watts.

(2) Power requirement: 115 volts, 50-60 Hz; 115 volts, 400 Hz or 230 volts, 50-60 Hz.

(3) Weight: 40 pounds.

3-6. RETRANSMISSION CABLE KIT MK-456A/GRC (TM 11-5995-202-15) (Fig 3-15)

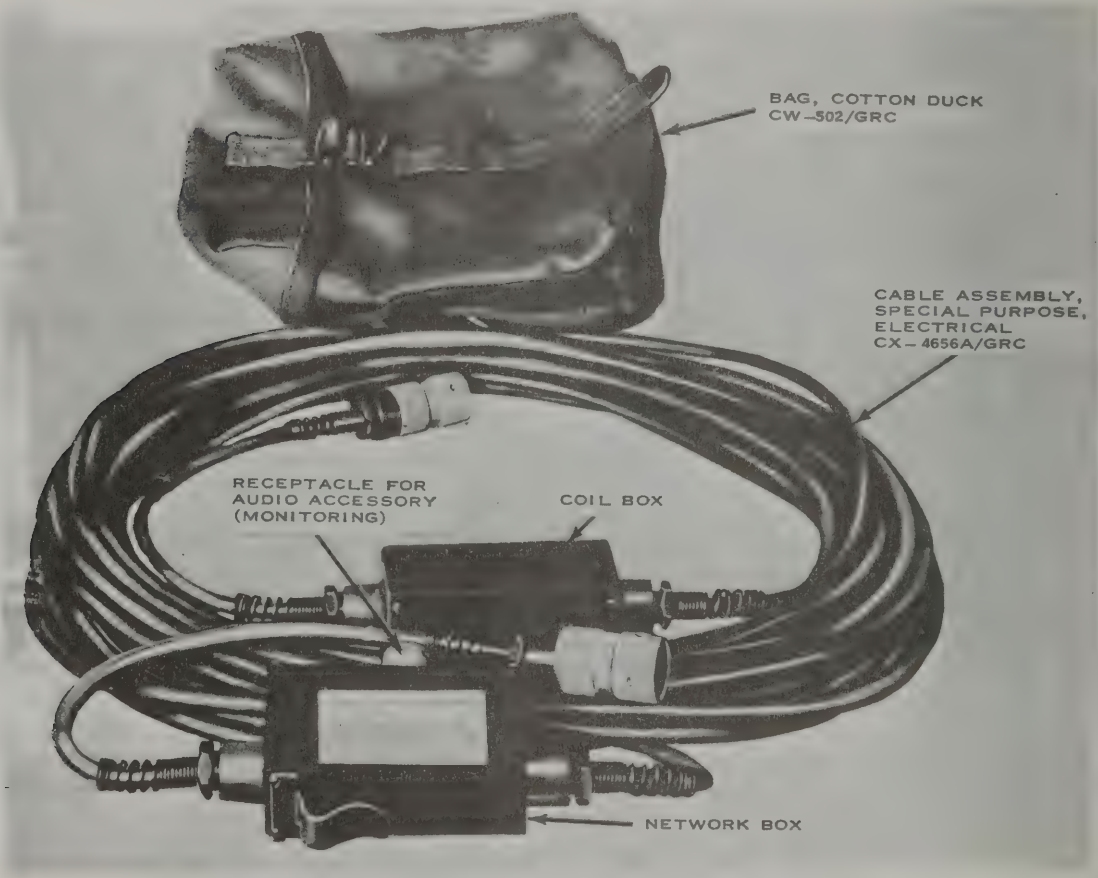


Figure 3-15. Retransmission Cable Kit MK-456A/GRC.

a. General. The MK-456A/GRC can be used between receiver-transmitters of the AN/VRC-12 and AN/PRC-77 series of radios. It consists of a 50-foot Cable Assembly, Special Purpose, Electrical CX-4656A/GRC with a canvas storage bag, Cotton Duck CW-502/PRC.

b. Utilization. Radios that are set up for retransmission are separated by the full length of the special purpose cable to reduce interference. Both sets must be operated in a squelch mode. The special purpose cable has a receptacle for connecting an audio accessory to monitor the circuit.

3-7. RADIO SET CONTROL GROUP AN/GRA-39(*) (TM 11-5820-477-12) (Fig 3-16)

Figure 3-16. Radio Set Control Group AN/GRA-39(*).

a. General. The AN/GRA-39(*) control group is used to provide remote operation of the AN/VRC-12 and AN/PRC-77 series of radios from a distance of up to 2 miles (3.2 kilometers). It has two major components: Control, Radio Set C-2328/GRA-39 (remote unit) and C-2329/GRA-39 (local unit). In addition, it has a Handset H-189/GR, a Carrying Bag, Cotton Duck CW-598/GRA-39, and 2 carrying slings. The A model has a call lamp on the front panel of the remote and local units. The control group also provides telephone communications between the local and remote units.

b. Utilization. The local unit is connected to the audio or speaker receptacle on the receiver-transmitter. Field Wire WD-1/TT may be used to interconnect the local and remote units. The remote unit has a loudspeaker. The control group can also be used in conjunction with an SB-22/PT switchboard to provide a radio-wire integration capability.

c. Technical Characteristics.

(1) Power requirement: Both units are battery operated by six BA-30 batteries (6.6-9.0 volts).

(2) Battery life: Remote unit--24 hours, local unit--72 hours.

(3) Weight: Remote unit--11.0 pounds, local unit--10.25 pounds, carrying bag--2.13 pounds. Total 23.38 pounds.

3-8. ELECTRICAL TRANSIENT SUPPRESSOR MX-778/GRC (TM 11-5915-223-12) (Fig 3-17)

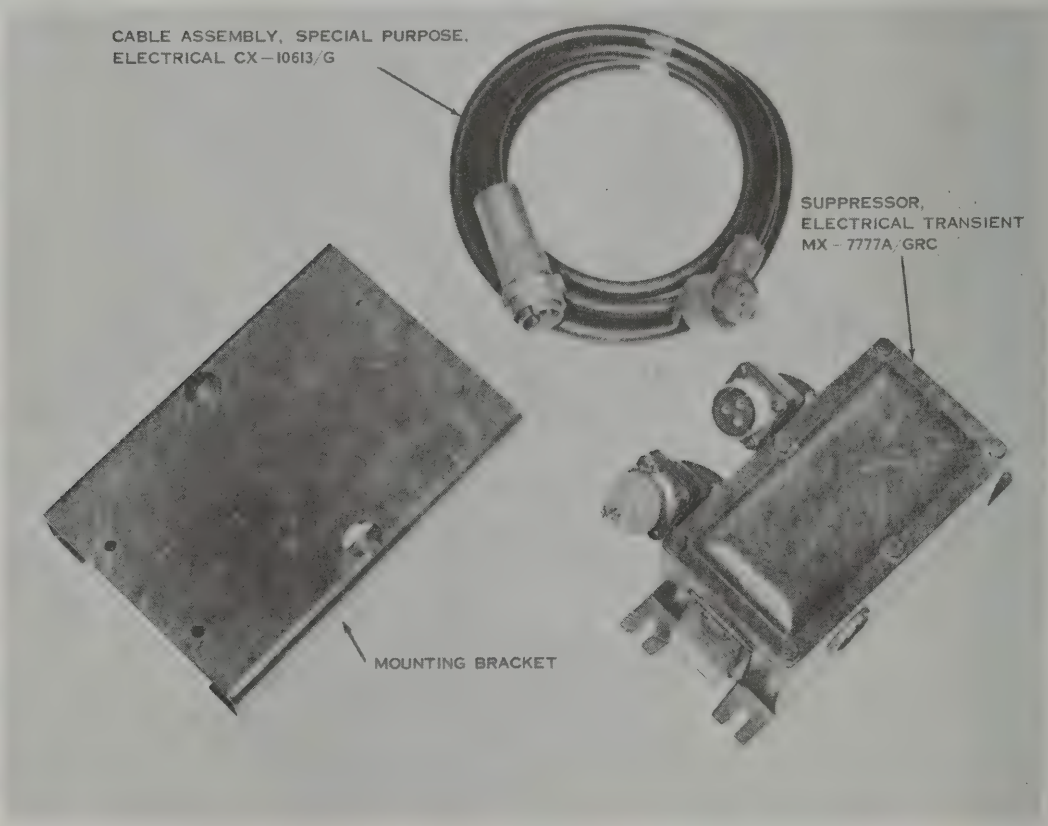


Figure 3-17. Electrical Transient Suppressor MX-778/GRC.

a. General. The MX-778/GRC suppressor prevents the high voltage electrical transients (spikes) or transposed voltage in a dc power system from being applied to transistorized radios, such as the AN/VRC-12, AN/PRC-77, and AN/GRC-106 series of radios. It has three basic components: Suppressor, Electrical Transient MX-7777A/GRC; Cable Assembly, Special Purpose, Electrical CX-10613/G; and a mounting bracket.

b. Utilization. The suppressor is normally installed in a vehicle between the dc electrical power system and the transistorized radio(s). More than 1 radio may be connected as long as the total load does not exceed 1,400 watts. It has only one control, an ON-OFF switch for the circuit breakers.

c. Technical Characteristics.

(1) Power output: 22-28 volts dc (same as input voltage), 1,400 watts.

(2) Power requirement: 22-28 volts dc, vehicular electrical power system.

(3) Weight: Suppressor--10.0 pounds, accessories (approx)--7.1 pounds. Total 17.1 pounds.

3-9. INTERCOMMUNICATION EQUIPMENT

a. Intercommunication Set AN/VIC-1(V) (TM 11-5830-340-12) (figs 3-18 and 3-19).

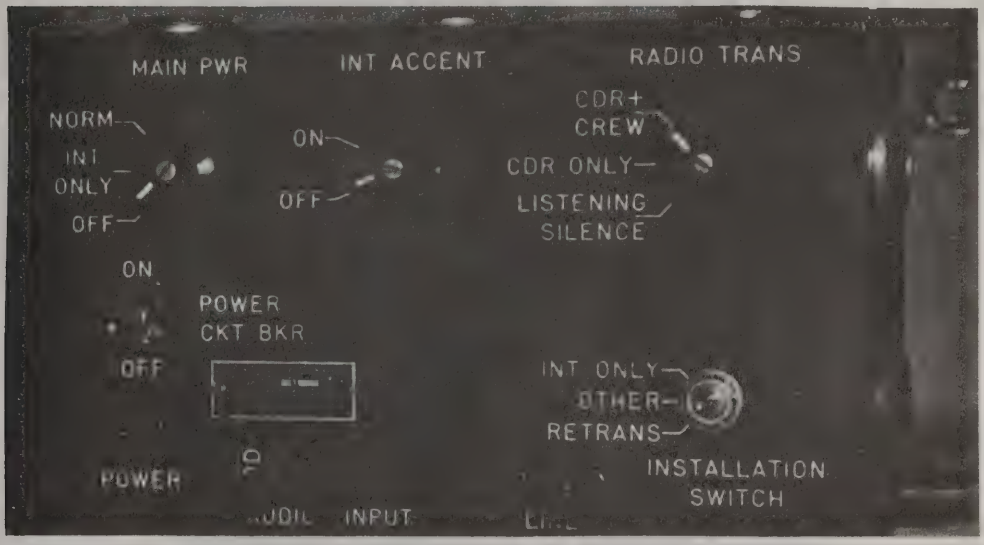


Figure 3-18. Amplifier, Audio Frequency AM-1780/VRC.

(1) General. The AN/VIC-1(V) intercommunication set provides voice communications between 2 to 5 vehicle crew members. It is used in those vehicles that do not have an intercommunication system as part of a radio set. It consists of two major components: a Control, Intercommunication Set C-2298/VRC is installed for each crew member who is to use the radio equipment (in a tank it is installed at each crew position except the driver's), and an Amplifier, Audio Frequency AM-1780/VRC, which amplifies the voice signals and controls their distribution throughout the system. Installation kits provided for specific vehicles may include other control boxes and audio accessories that are used in conjunction with the AN/VIC-1(V) intercommunication set. In addition, Cable Assembly, Special Purpose Electrical CX-4720/VRC is used to connect the vehicular power supply to the amplifier and one CX-4723/VRC is used to connect the amplifier to each control box.

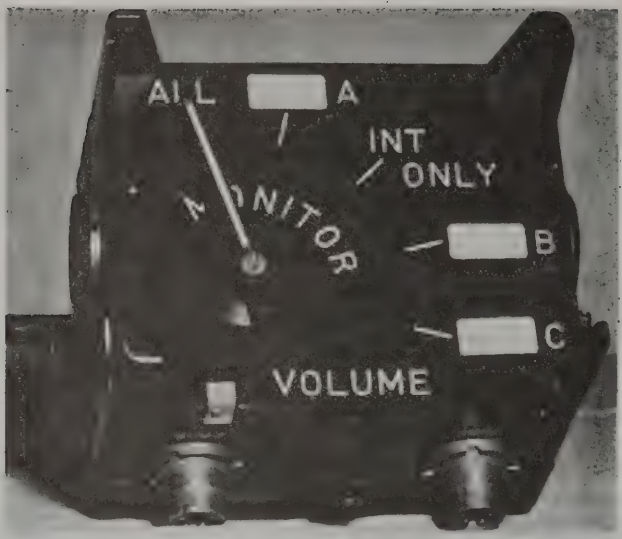


Figure 3-19. Control, Intercommunication Set C-2298/VRC.

(2) Utilization. The AM-1780/VRC amplifier is the main function box for the intercommunication system. It has controls for both power and amplification. The AM-1780/VRC provides corrections between the amplifier and the crew member's audio accessories. It has a volume control and a radio/intercommunication selector switch. Installation is in accordance with the following technical manuals:

Vehicle	Technical manual
M113, M113A1	11-2300-355-15-7
M60	11-2300-361-15-4
M60A1	11-2300-361-15-2
	11-2300-361-15-3
M551	11-2300-360-15-1
AVLB (M6A1 chassis)	11-2300-361-15-1

The intercommunication set may be used for nonvehicular installations when the correct dc power source is available. It has two line binding posts that may be used to connect a remotely located telephone or switchboard into the vehicular intercommunication system.

(3) Technical characteristics.
Power requirement: 24-volt dc vehicular electrical power supply.
Power output: Amplifier 1 watt.
Weight: Amplifier--7.9 pounds. Control box--2.5 pounds.

b. Control, Frequency Selector C-2742/VRC (TM 11-5820-401-12) (fig 3-20).

(1) General. The C-2742/VRC frequency selector is used with the RT-246(*)/VRC to provide remote automatic selection of the 10 preset frequencies. It can also control the input and high and low transmission power. It is a component of a vehicle installation kit.

(2) Utilization. The frequency selector is connected to the receiver-transmitter and may be connected to another frequency selector. In a tank installation, it is located at both the tank commander's and loader's positions.

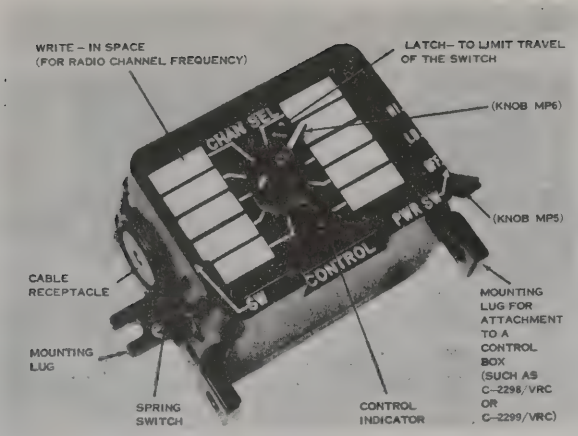


Figure 3-20. Control, Frequency Selector C-2742/VRC.

c. Control, Intercommunication Set C-2297/VRC (fig 3-21).

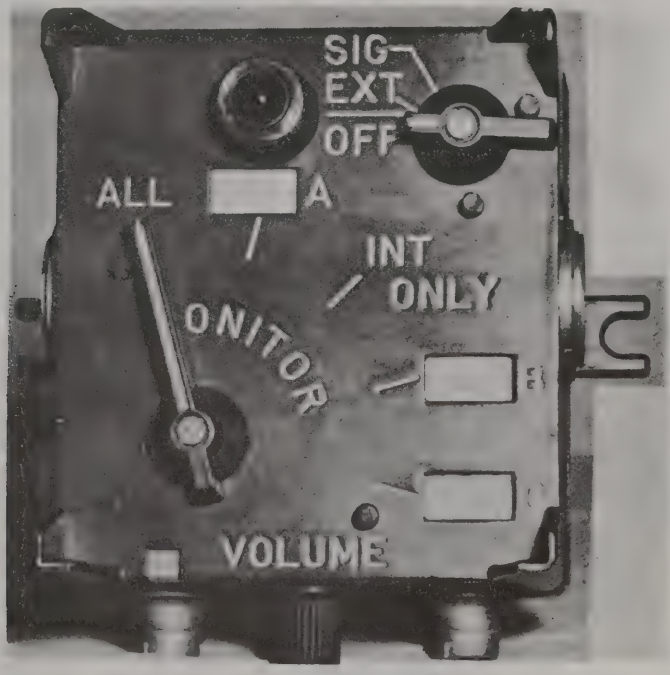


Figure 3-21. Control, Intercommunication Set C-2297/VRC.

(1) General. The C-2297/VRC control provides connections between the radio and the audio accessories of a vehicle crew member. It also controls the operation of Control, Intercommunication Set C-2296/VRC (d below).

(2) Utilization. The C-2297/VRC control serves the same purpose as the C-2298/VRC (a above). In addition, it is connected to and controls (ON, OFF, and SIGNAL) the external control box. It is installed in the driver's position in a tank or M551.

d. Control, Intercommunication Set C-2296/VRC (fig 3-22).

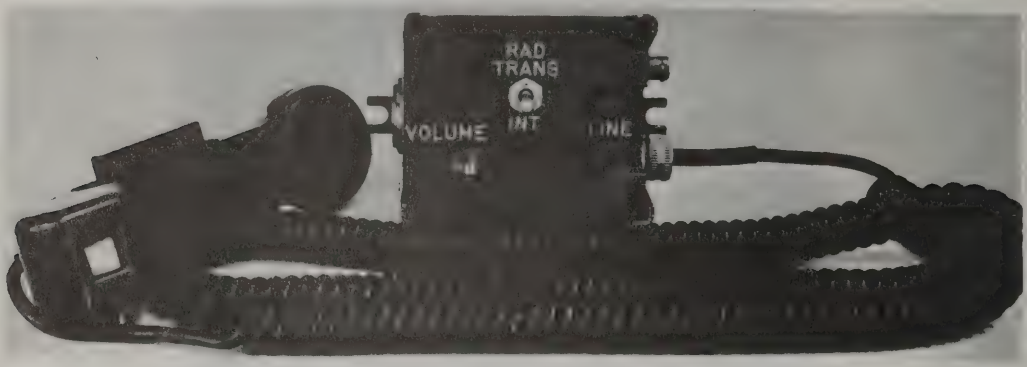


Figure 3-22. Control, Intercommunication Set C-2296/VRC.

(1) General. The C-2296/VRC control provides communication between the crew and personnel outside a vehicle, and it also permits personnel outside the vehicle to operate the vehicular radio system. In addition to the control box, it has a Handset H-207/VRC.

(2) Utilization. Using the handset, a person outside a vehicle can communicate with the crew or operate over the vehicular radio set. A pair of line binding posts provide the capability of connecting the vehicular intercommunication system into a remotely located telephone or switchboard.

e. Control, Radio Set C-2299/VRC (fig 3-23).

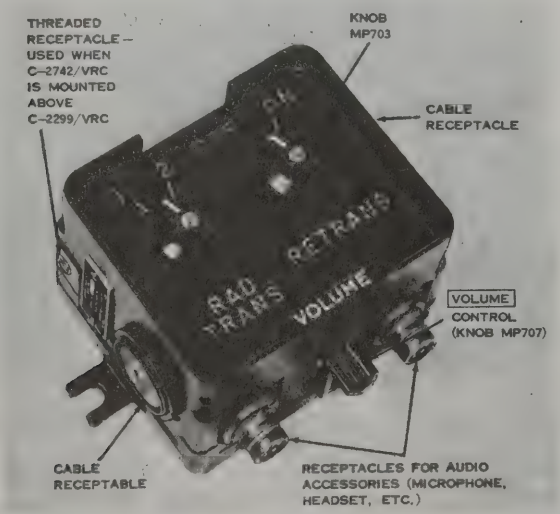


Figure 3-23. Control, Radio Set C-2299/VRC.

(1) General. The C-2299/VRC control is used in the AN/VRC-49 radio configuration to enable the two receiver-transmitters to perform automatic retransmission of signals at a relay site. In some installations it is provided as a convenient connector for audio accessories to control one receiver-transmitter.

(2) Utilization. Retransmission is selected by an ON-OFF switch. In the OFF position, either of the receiver-transmitters can be operated by an audio accessory by using the 1-2 selection switch.

3-10. AUDIO ACCESSORIES

Most of the audio accessories are provided as components of the vehicular installation kits. All of them have five-pin connectors.

a. Headset H-140A/U (TM 11-5965-260-15P) (fig 3-24).

Figure 3-24. Headset H-140A/U.

The H-140A/U headset consists of a pair of earphones mounted on a spring steel, headband assembly. The H-251/U headset is similar to the H-140A/U and they can be used interchangeably.

b. Microphone, Dynamic M80(*)/U (TM 11-5965-268-50), (fig 3-25).

The M80(*)/U is a noise-cancelling microphone with a push-to-talk switch and a 5-foot retractile cord. It can be connected to either the intercommunication or the radio circuits.

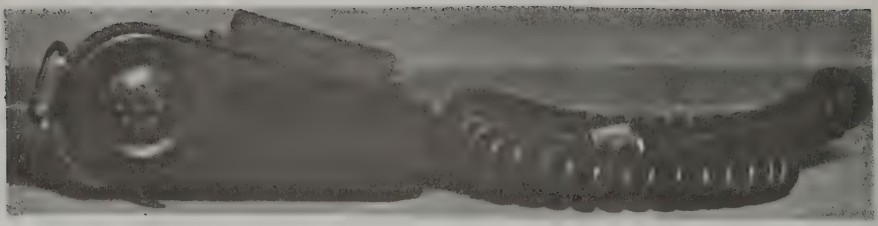


Figure 3-25. Microphone, Dynamic M80(*)/U.

c. Handset H-189/GR (TM 11-5965-280-15) (fig 3-26). The H-189/GR is a watertight handset that replaces the H-138(*)/U. It has a 6-foot retractile cord. A clip on the back permits it to be attached to a belt or pocket. The press-to-talk switch is nonlocking. This handset is a component of the AN/PRC-77 radio.

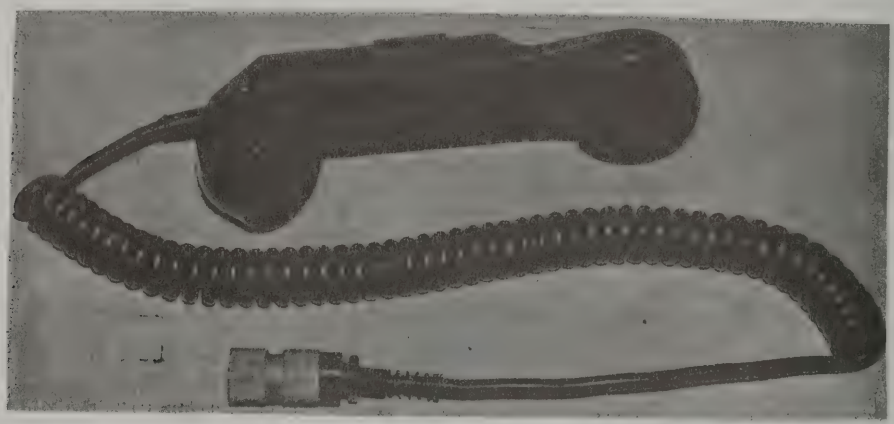


Figure 3-26. Handset H-189/GR.

d. Handset H-250/U (fig 3-27). The H-250/U handset is lighter than the H-189/GR. They can be used interchangeably.

Figure 3-27. Handset H-250/U.

e. Headset-Microphone H-161(*)/U (TM 11-5965-262-13) (fig 3-28). The H-161(*)/U headset-microphone can be used in high noise areas. It may be worn under a helmet. It consists of two earphone cups, a headband, microphone and boom, chest switch, and retractile cable. The A model is wired to reduce background noise and has a chest strap instead of a clothing clip. The chest switch has three positions: ICS for talking and listening on the intercommunication set, a center OFF position for radio monitoring, and a RAD (spring-loaded) position for radio transmission.

f. Combat Vehicle Crewman's (CVC) Helmet (TM 11-5965-282-15) (fig 3-29).

The combat vehicle crewman's (CVC) helmet has a Headset-Microphone Kit MK-1039/G installed in it. The kit consists of two Earphones; Dynamic H-269/G, a microphone boom switch, and upper and lower (retractile) cords. The upper cord has an attached clothes clip. The switch has three positions. The operator can listen on both the radio and intercommunication set in each position. In addition, in the rear position he can talk over the intercommunication set, and in the forward position he can transmit over the radio. The CVC helmet is authorized for combat vehicle crewmen based on CTA 50-902 (mobilization) or CTA 50-901 (peacetime).

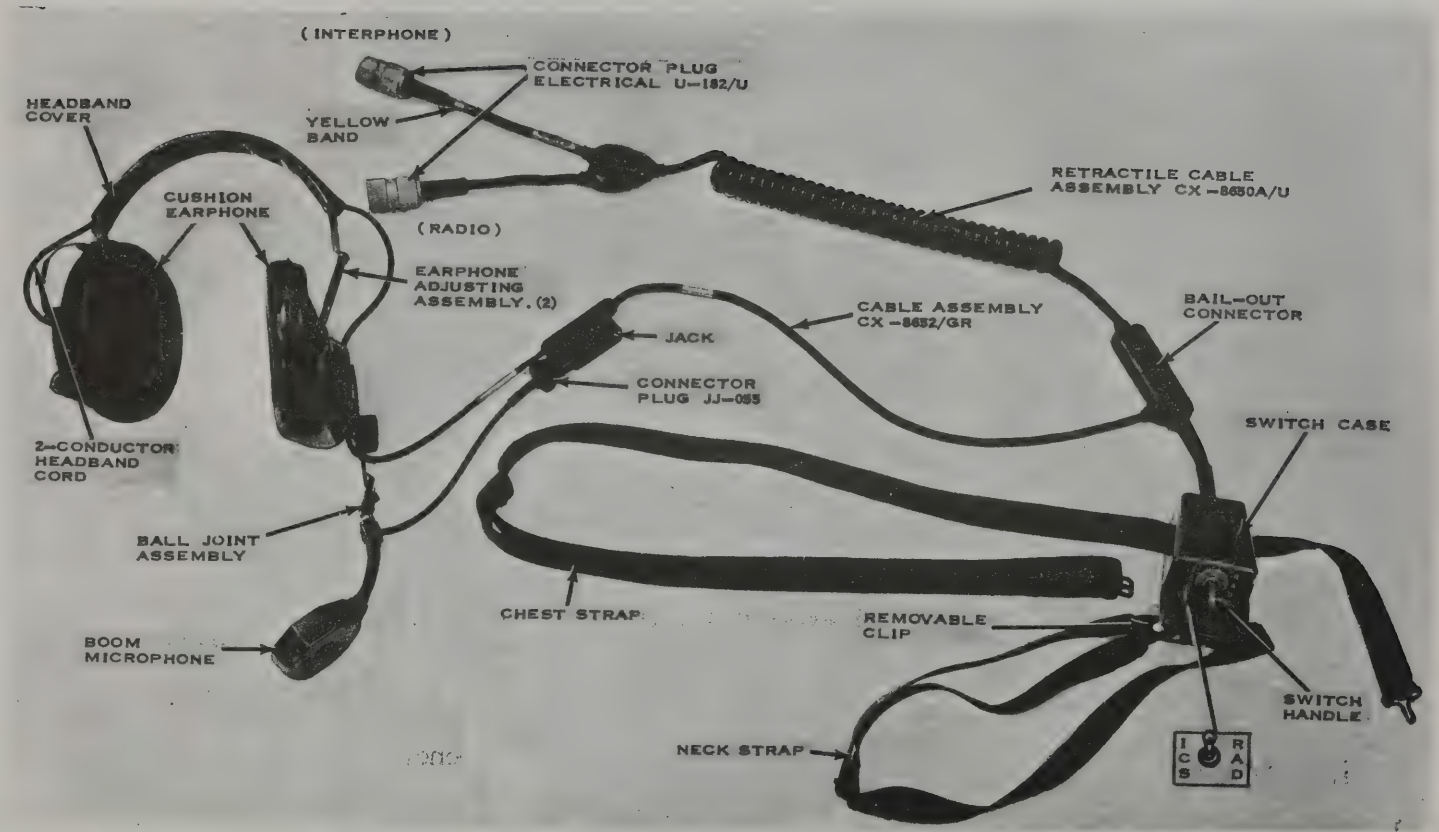


Figure 3-28. Headset-Microphone H-161A/U.

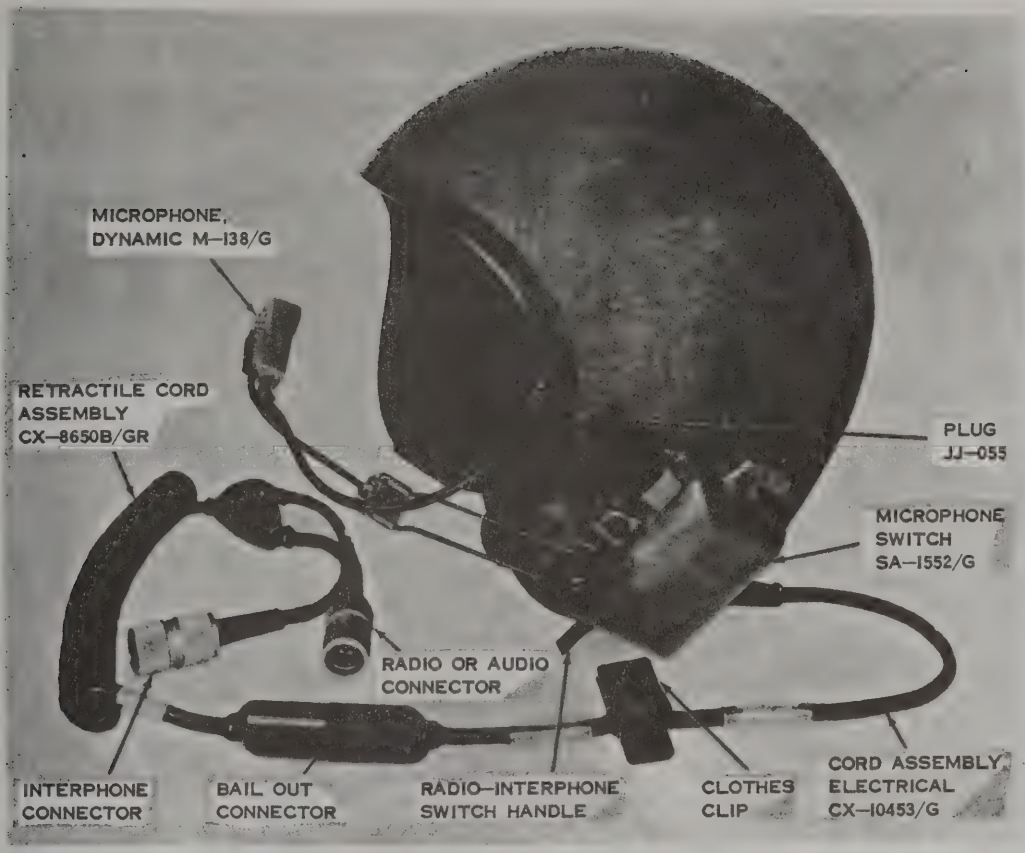


Figure 3-29. Headset-Microphone Kit MK-1039/G installed in CVC helmet.

g. Loudspeaker, Permanent Magnet LS-454/U (TM 11-5965-255-15P) (fig 3-30).

The LS-454/U loudspeaker can be connected to the radio speaker receptacle on the radios or to the radio receptacle on the control boxes. It can be used with Cable Assembly, Special Purpose, Electrical CX-7867/VRC as an extension cord. The clamp allows the unit to be mounted in a convenient place near the radio.

h. Loudspeaker, Electromagnetic LS-549/PRC (fig 3-31).

The LS-549/PRC loudspeaker can be used with the AN/PRC-77 radio set. It can be clipped to a helmet, harness, or radio set, or it can stand on a flat surface. Headset, Electrical H-264/PRR-9 can be worn in the ear to improve reception in noisy areas. It has 2 connecting cables (2-foot and 8-foot). When the H-264/PRR-9 headset is connected to the loudspeaker, the loudspeaker will be cut off and sound will be heard only in the headset.

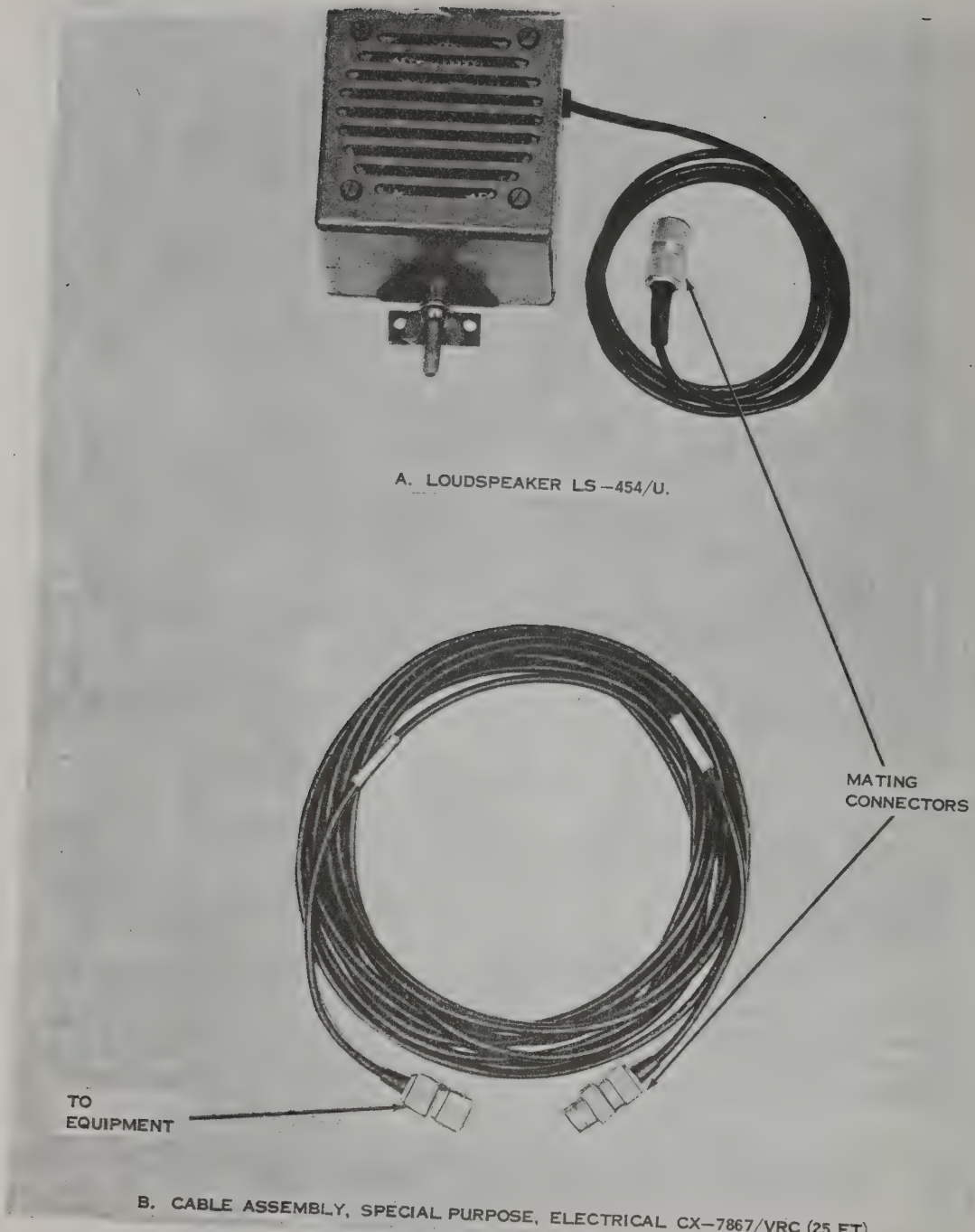


Figure 3-30. Loudspeaker, Permanent Magnet LS-454/U.

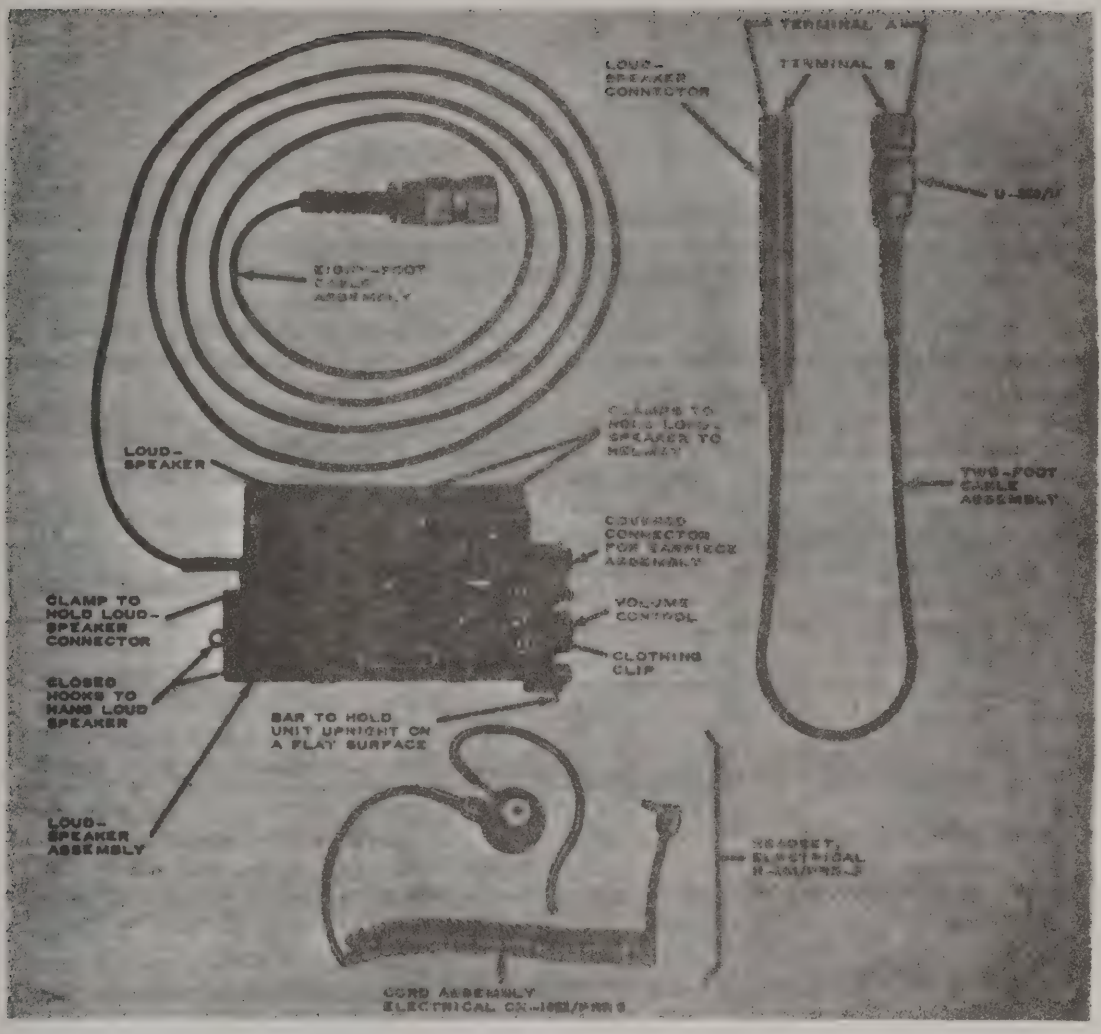


Figure 3-31. Loudspeaker, Electromagnetic LS-549/PRC.

CHAPTER 4

AM SINGLE SIDEBAND (SSB) RADIO EQUIPMENT

4-1. GENERAL

Single sideband (SSB) communications systems have been in use by the military for many years. The original applications were in large, fixed stations for long range, point-to-point communications in the high frequency (HF) band. Because of its many inherent advantages, SSB is replacing conventional, amplitude modulated (AM) portable, vehicular, and avionics communications equipment for use in the crowded HF and very high frequency (VHF) bands. The fundamental principles and theory of SSB radio communications are contained in TM 11-685.

4-2. AM SINGLE SIDEBAND (SSB) EQUIPMENT

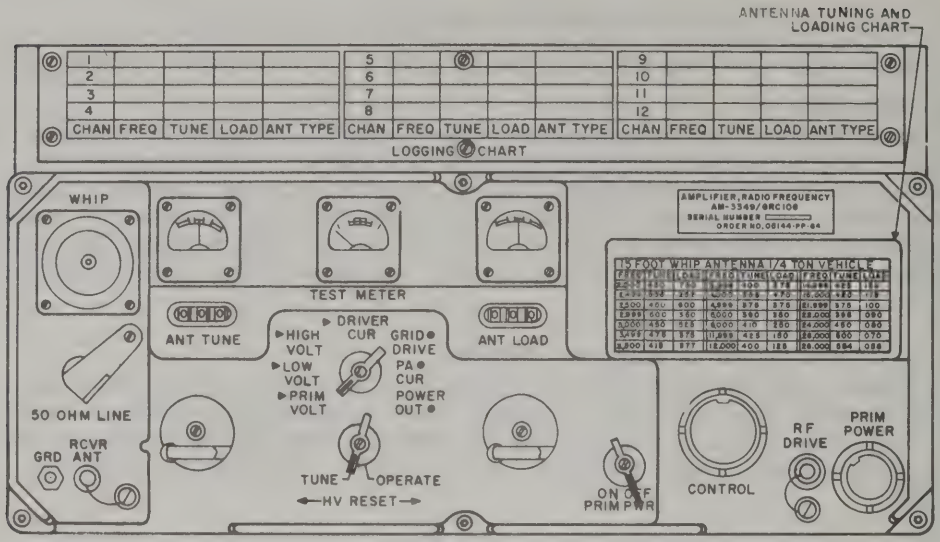
The basic tactical AM-SSB radio set is the AN/GRC-106. It is found in the armored cavalry squadron, the armored brigade headquarters, and the armored cavalry regiment. The AN/GRC-106 radio set, in combination with teletypewriters and other accessory equipment, makes up several radio teletypewriter sets. These configurations are shown in figure 4-1.

	RT-834	AM-3349	MD-522	TT-76	TT-98	TT-4	REPLACES
AN/GRC-106	1	1					AN/GRC-19
AN/GRC-142	1	1	1	1	1		AN/GRC-46
AN/GRC-122	2	1	1	1	2		AN/GRC-26D
AN/VSC-2	1	1	1			1	AN/VSC-1
AN/VSC-3	1	1	1	1	1		AN/VRC-29

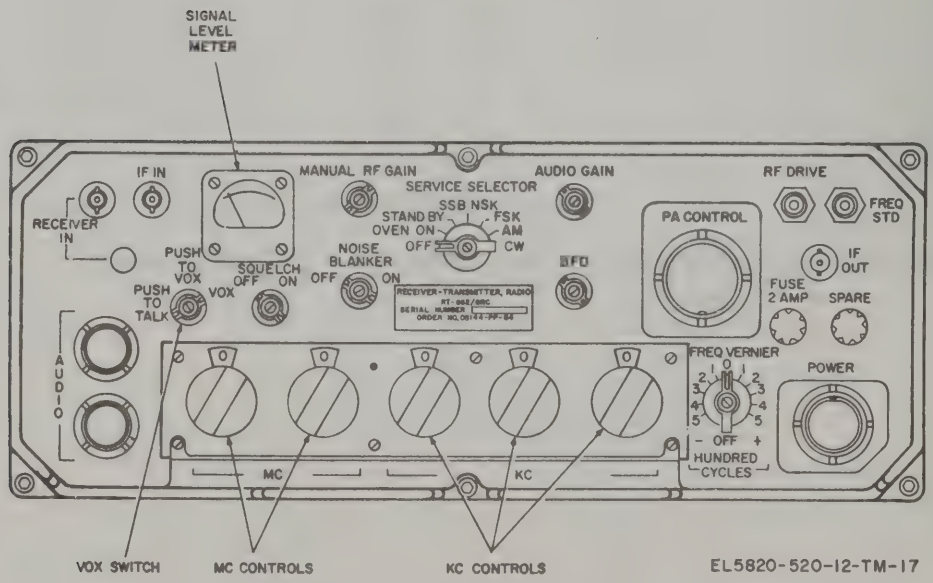
Figure 4-1. Radio Set AN/GRC-106 configurations.

Only the AN/VSC-3 and AN/GRC-142 configurations are employed in armor units.

4-3. RADIO SET AN/GRC-106A (TM 11-5820-520-12) (Figs 4-2 and 4-3)



Amplifier, Radio Frequency AM-3349/GRC-106



Receiver-Transmitter, RT-662/GRC

Figure 4-2. Radio Set AN/GRC-106A.

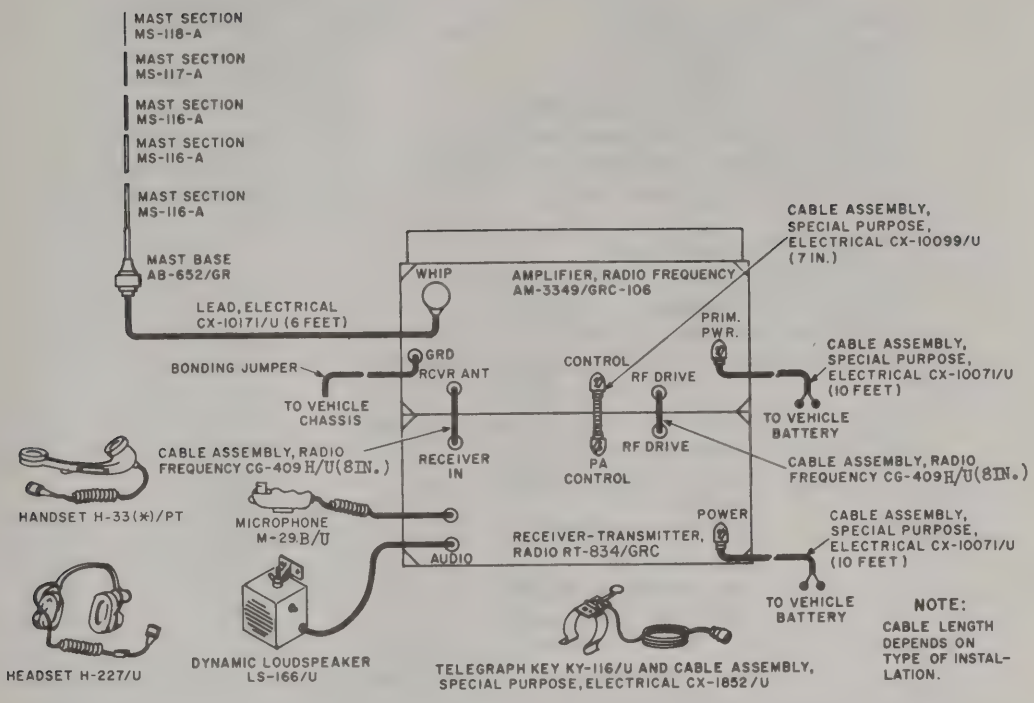


Figure 4-3. Radio Set AN/GRC-106A, typical cording diagram.

a. General. The AN/GRC-106A is a vehicular-mounted radio set with three operating modes: upper sideband voice, upper sideband compatible AM, and continuous wave. Frequency shift keyed and narrow frequency shift keyed signals can be transmitted and received using appropriate radio teletypewriter equipment. It has a planning range of 50 miles (80 kilometers) for ground wave and 100-1,500 miles (161-2414 kilometers) for sky wave. It has no retransmission capability. The Radio Set Control Group AN/GRA-74 or Control Group AN/GRA-6 (para 4-6) may be used to provide remote operation.

b. Components.

(1) Receiver-Transmitter, Radio RT-834/GRC (RT-662/GRC in the AN/GRC-106).
(2) Amplifier, Radio Frequency AM-3349/GRC-106.
(3) Loudspeaker, Dynamic LS-166/U (para 4-7a).
(4) Handset H-33(*)/PT (para 4-7b).
(5) Headset, Electrical H-227/U (para 4-7c).
(6) Microphone, Carbon M29B/U (para 4-7d).
(7) Key, Telegraph KY-116/U (para 4-8a).
(8) Five-section, 15-foot whip antenna (Mast Base AB-652/GR; three, MS-116A's, bottom; MS-117A, middle; MS-118A, top).
(9) Antenna Group AN/GRA-50 (para 7-7).
(10) Mounting MT-3140/GRC-106 (two for track vehicle installation).

c. Utilization. Detailed installation information is contained in the following technical manuals:

Vehicle	Technical Manual
Truck, 1/4-ton, M38A1	TM 11-2300-350-15-1
Truck, 1/4-ton, M151	TM 11-2300-351-15-1
Truck, 3/4-ton, M37	TM 11-2300-352-15-1
Truck, 2-1/2-ton, M34, M35, M211	TM 11-2300-353-15-1
Carrier, Armored Personnel, M113, M113A1	TM 11-2300-355-15-1
Carrier, Armored Personnel, M114, M114A1	TM 11-2300-356-15-1
Carrier, Command Post, M577	TM 11-2300-359-15-1

d. Technical Characteristics.

(1) Frequency range: 2.000-29.999 MHz.
(2) Number of channels: 280,000.
(3) Channel spacing: 100 Hz.
(4) Power output: 400 watts, voice;
200 watts, CW
(5) Power requirement: 27 volts dc, 1,204 watts.
(6) Squelch: Noise operated.
(7) Weight:

Receiver-Transmitter	46.5 pounds
Amplifier	71.5 pounds
Audio accessories	7.2 pounds
Antenna group	15.0 pounds
Whip antenna and base	2.9 pounds
Cables and accessories	7.6 pounds
Total	150.7 pounds

Exact total weight will depend on specific type installation.

4-4. RADIO TELETYPEWRITER SET AN/VSC-3 (TM 11-5815-332-15) (Fig 4-4)

a. General. The AN/VSC-3 is a one-way reversible radio teletypewriter configuration of the AN/GRC-106A radio (para 4-3). It also has the voice and CW capability of the AN/GRC-106A radio.

b. Components. The principal components, in addition to the Radio Set AN/GRC-106A, are:

(1) Teletypewriter TT-98(*)/FG (para 4-8b).
(2) Reperforator-Transmitter, Teletypewriter TT-76(*)/GGC (fig 8-20).
(3) Modem, Radio Teletypewriter MD-522A/GRC (para 4-8c).
(4) Motor Generator PU-724/G (Inverter).
(5) Device, Low Level Signalling TT-523A/GGC (para 4-8d).
(6) Crossbar assembly.
(7) Clock, aircraft, 8-day.
(8) Accessory Kit, Electronic Equipment MK-1506/VSC-3 (with batteries, clipboard, chair, flashlight, dust covers, tools, and teletypewriter supplies).

c. Utilization. The AN/VSC-3 is mounted in a Carrier, Command Post M577A1, in accordance with TM 11-2300-359-15-3. For remote operation, in addition to the control group, a Teletypewriter TT-4C/TG (para 8-6a) or equivalent, is required at the remote location. Electrical Teletype Security Equipment TSEC/KW-7 can be used to provide secure radioteletype operation. The signalling device TT-523A/GGC is also required for secure operation.

d. Technical Characteristics. Technical characteristics are the same as those for the Radio Set AN/GRC-106A, (para 4-3d), except for the following:

(1) Power requirement: 28 volts dc, 2,800 watts.

(2) Weight:

Teletypewriter	54 pounds
Reperforator-transmitter	45 pounds
Modem	35 pounds.

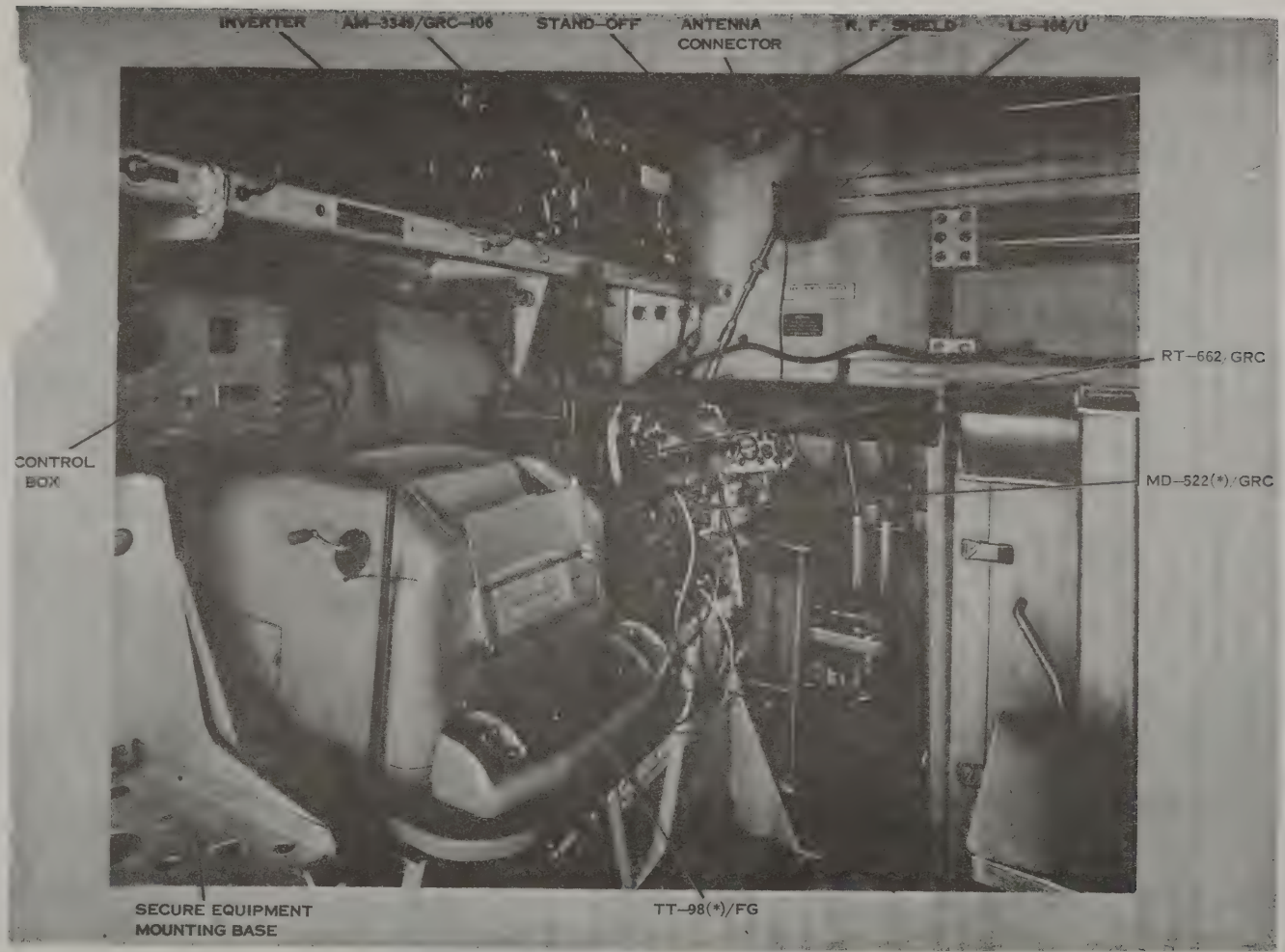


Figure 4-4. Radio Teletypewriter Set AN/VSC-3.

4-5. RADIO TELETYPEWRITER SET AN/GRC-142(*) (TM 11-5815-334-12) (Fig 4-5)

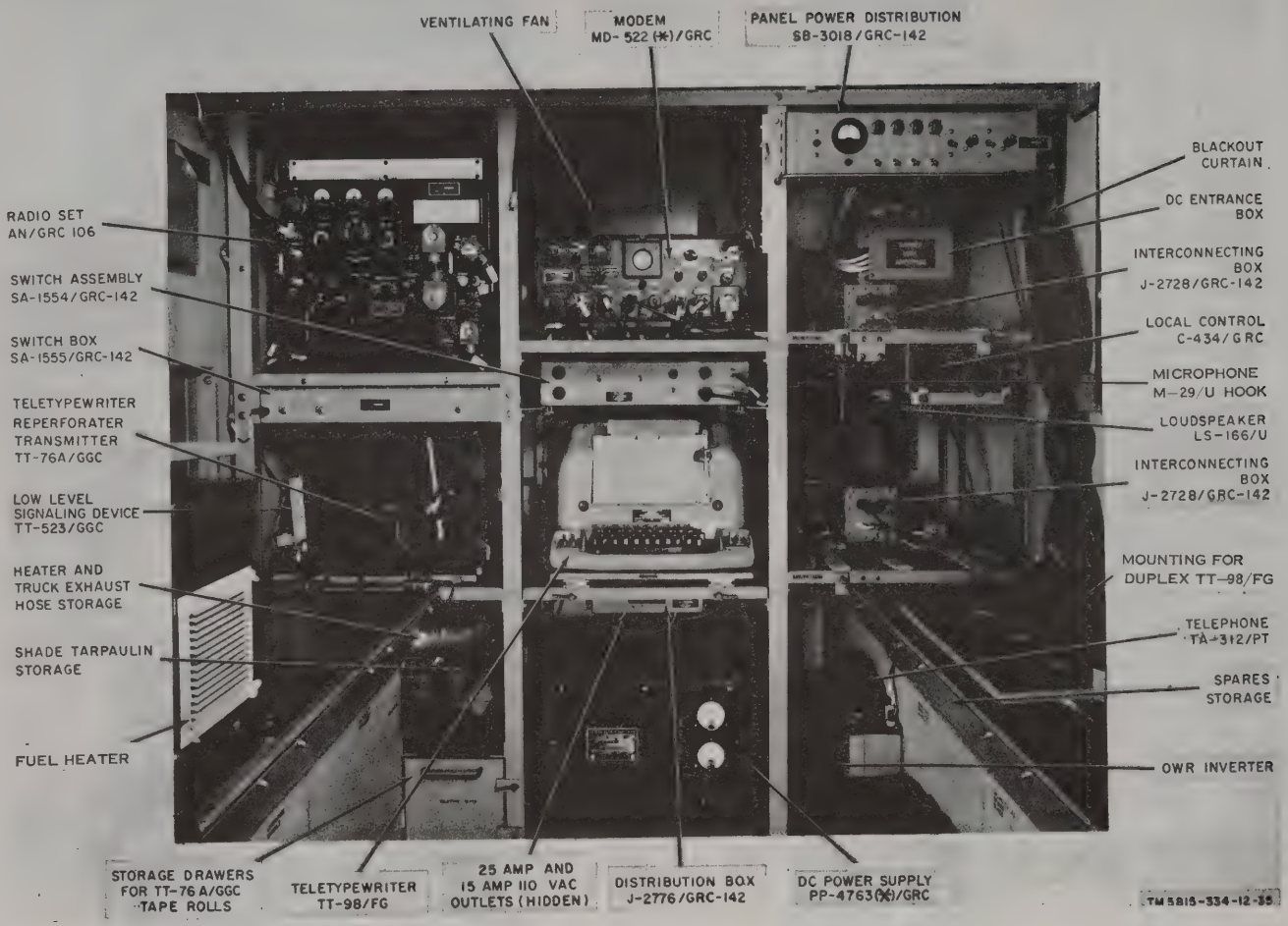


Figure 4-5. Radio Teletypewriter Set AN/GRC-142(*).

a. General. The AN/GRC-142 is a shelter-contained configuration of the AN/GRC-106A radio (para 4-3) that provides one-way reversible radioteletype operation. It also has the voice and CW capability of the AN/GRC-106A radio.

b. Components. The principal components, in addition to the Radio Set AN/GRC-106A are:

(1) Shelter, Electrical Equipment S-318/G (TM 11-5410-212-15P), for 142 and 142A, or Shelter, Electrical Equipment S-250/G (TM 11-5410-204-15P), for 142B.
(2) Teletypewriter TT-98(*)/FG (para 4-8b).
(3) Reperforator-Transmitter, Teletypewriter TT-76A/(GGC) (fig 8-20).
(4) Modem, Radio Teletypewriter MD-522A/GRC (para 4-8c).
(5) Control Group AN/GRA-6 (para 4-6).
(6) Device, Low Level Signalling TT-523A/GGC (para 4-8d).
(7) Motor Generator PU-724/G (Inverter).
(8) Standing-Wave-Ratio Power Meter ME-165/G (para 4-8e).
(9) Power Supply PP-4763(*)/GRC (para 4-8f).

c. Utilization. The AN/GRC-142 and 142A are usually mounted on a 3/4-ton truck. The AN/GRC-142B is usually mounted on a 1-1/4-ton truck. For remote operation, in addition to the control group, a TT-98 or TT-76 teletypewriter is required at the remote location. Electrical Teletype Security Equipment TSEC/KW-7 can be used to provide secure radioteletype operation. The Signalling Device TT-523A/GGC is also required for secure operation.

d. Technical Characteristics. Technical characteristics are the same as those for the Radio Set AN/GRC-106A, (para 4-3d) except for the following:

(1) Power requirement: 28.5 volts dc; 2,850 watts
(2) Weight: Shelter S-318(*)/G(142)--1,694 pounds
Shelter S-318(*)/G(142A)--1,552 pounds
Shelter S-250/G(142B)--1,900 pounds.

4-6. RADIO SET CONTROL GROUP AN/GRA-6 (TM 11-5038) (Fig 4-6)

Figure 4-6. Control Group AN/GRA-6.

a. General. Control Group AN/GRA-6 provides the means for controlling and operating a radio set using 1 or 2 receiver-transmitters from a position approximately 2 wire miles away from the location of the radio set. In addition, it provides for local control of the radio set and for two-way telephone communication between the remote and local operators. The major components are: Local Control C-434/GRC, Remote Control C-433/GRC with carrying strap, Handset H-33(*)/PT, Interconnecting Box J-654/G, and a canvas container Bag CW-189/GR with carrying strap. Field Wire WD-1/TT is used to connect the local and remote but is not a part of the control group.

b. Utilization. An additional H-33(*)/PT handset is required to provide two-way telephone communication between the remote and local operators. The J-654/G interconnecting box is provided to permit simultaneous use of a handset and loudspeaker (not part of the control group) at the remote control.

c. Technical Characteristics.

(1)	Telephone signal:	20 Hz, 100 volts (open circuit).
(2)	Telephone signal indicator:	Neon glow lamp or bell.
(3)	Power requirement:	3 volts dc for local and remote unit microphone power provided by two Batteries BA-30; 45 volts dc for remote unit control power provided by Battery BA-414/U.
(4)	Weight:	Remote control-- 7.0 pounds
		Local control-- 10.5
		Accessories and minor components 4.4 pounds
		Total 21.9 pounds

4-7. AUDIO ACCESSORIES

All the audio accessories terminate in a 10-pin Connector, Plug, Electrical U-77/U or U-161/U.

a. Loudspeaker, Dynamic LS-166/U (TM 11-5965-222-15P) (fig 4-7). The LS-166/U loudspeaker contains a permanent magnet dynamic speaker and matching transformer. It has a two-position output level switch and a 6-foot cord.

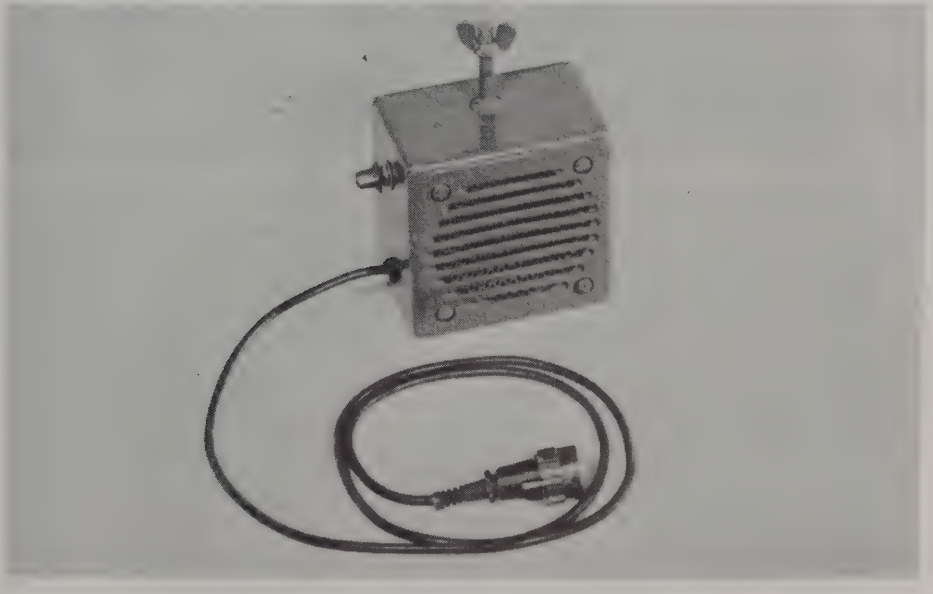


Figure 4-7. Loudspeaker, Dynamic LS-166/U.

b. Handset H-33(*)/PT (TM 11-5965-202-35) (fig 4-8). The H-33(*)/PT is a standard type handset with a nonlocking push-to-talk switch, and a 5-foot retractable coil cord.

Figure 4-8. Handset H-33(*)/PT.

c. Headset, Electrical H-227/U (fig 4-9). The H-227/U headset consists of two soft rubber earpieces mounted on a thin, metal adjustable headband covered with cushioning material. It has a 10-foot retractable coil cord.

Figure 4-9. Headset, Electrical H-227-U.

d. Microphone, Carbon M29B/U (TB Sig 272) (fig 4-10). The M29B/U is a unidirectional, low-impedance carbon-element, hand-held microphone. It has a push-to-talk switch and a 5-foot retractable coil cord.

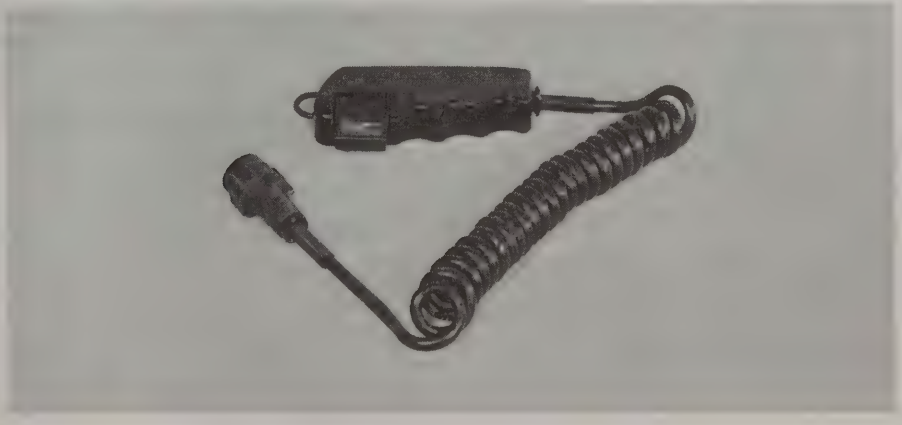


Figure 4-10. Microphone, Carbon M29B/U.

4-8. RADIO TELETYPE AUXILIARY EQUIPMENT

a. Key, Telegraph KY-116/U (fig 4-11). The KY-116/U telegraph key in a CW hand-keying device that has an adjustable metal band that can be clamped to the operator's leg. It is connected to the radio teletypewriter equipment through a 6-foot special purpose Electrical Cable Assembly CS-1852/U that terminates in a 10-pin Connector, Plug, Electrical U-77/U.

Figure 4-11. Key, Telegraph KY-116/U.

b. Teletypewriter TT-98(*)/FG (TM 11-5815-200-12) (fig 4-12).

(1) General. The TT-98(*)/FG teletypewriter is a component of the AN/FGC-20X and AN/UGC-4 teletypewriter sets. Both sets are identical and include a PP-978/FG power supply mounted in the teletypewriter. The only difference is that the AN/FGC-20X has a table, Teletypewriter FM-59/FG. The TT-98(*)/FG is a page printer and keyboard transmitter teletypewriter. It can be used for half or full duplex (does not record the message being sent) operation.

(2) Utilization. The power supply is a rectifier that provides dc for the line signal and local circuits, and adjusted ac for the ac circuits. Roll or fanfold paper may be used.

(3) Technical characteristics.

(a) Operational speeds: 60 and 100 words per minute (gears for 66 and 75 words per minute may be used but are not components).

(b) Power requirement: 95-125 volts or
190-250 volts,
50-60 Hz, 180 watts.

(c) Weight: Teletypewriter--54 pounds
power supply--7 pounds
table--22 pounds.

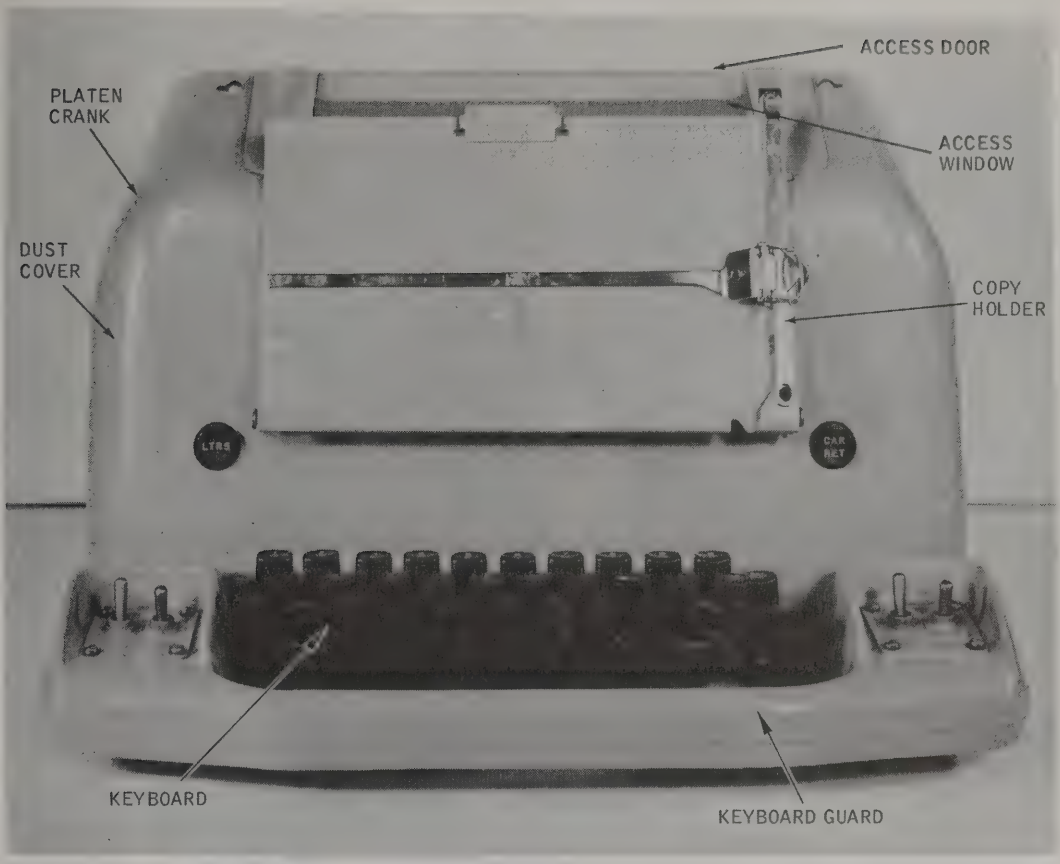


Figure 4-12. Teletypewriter TT-98(*)/FG.

c. Modem, Radio Teletypewriter MD-522A/GRC (TM 11-5805-387-15-2) (fig 4-13).

(1) General. The MD-522A/GRC radio teletypewriter modem converts dc current pulses in a standard code from a sending teletypewriter and converts them into audio tones and performs the opposite function for a receiving teletypewriter. It can be employed in a landline system (with isolation amplifiers), to provide teletypewriter communications between a local and a remote teletypewriter and as part of a radio teletypewriter system. It has 5 modes of operation: 850 Hz frequency shift keying, 85 Hz narrow shift keying, 85 Hz diversity, 300-3000 Hz voice, and narrow shift keying plus voice. It is capable of both one-way reversible and duplex operation. The modem has only one major component.

(2) Utilization. The Mounting MT-3140/GRC-106 (used with the AN/GRC-106A radio set) may be used as a mounting base for the radio teletypewriter modem.

(3) Technical characteristics.

(a) Operating rate: In excess of 100 words per minute.

(b) Signal level: Space 0 Ma
Mark 20 or 60 Ma.

(c) Power output: 200 millivolts.

(d) Power requirement: 27 volts dc, 37.8 watts.

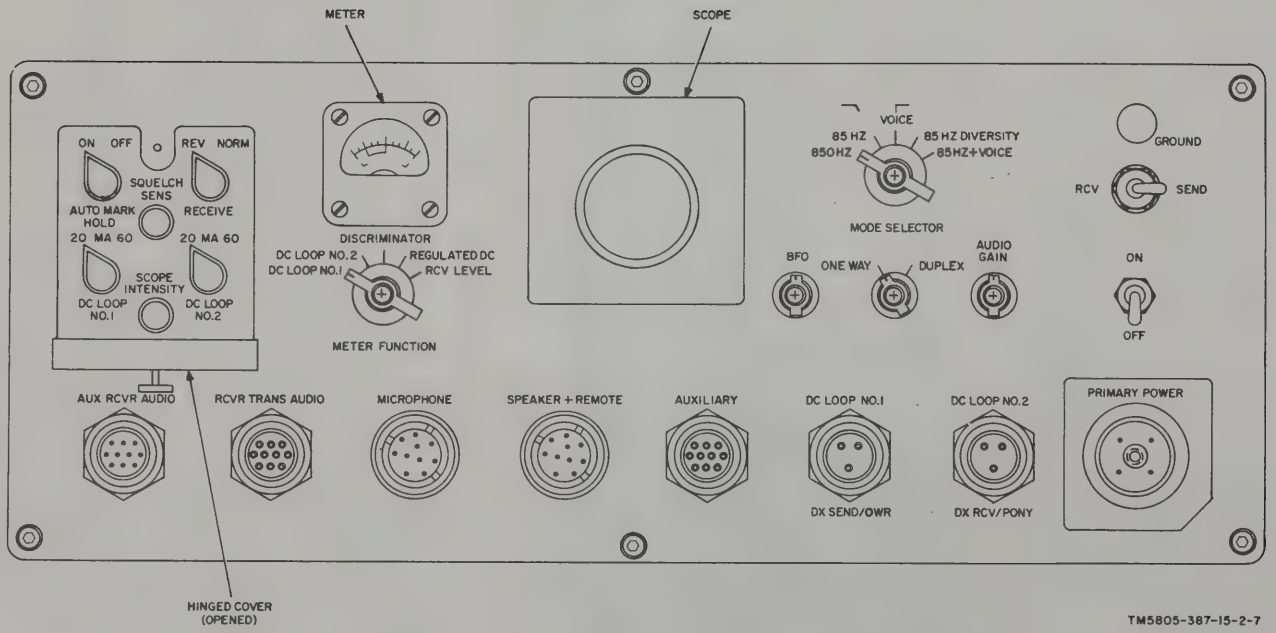


Figure 4-13. Modem, Radio Teletypewriter, MD-522A/GRC.

Figure 4-14. Device, Low Level Signalling TT-523A/GGC.

d. Device, Low Level Signalling TT-523A/GGC (TM 11-5815-338-15) (fig 4-14).

(1) General. The TT-523A/GGC signalling device reduces electromagnetic radiation from the teletypewriter perforator-transmitter TT-76(*)/GGC. It can only be used with the A, B, and C models of the TT-76, by providing a means of performing the off-line tape punching functions at lower voltage and current levels. It is bypassed during on-line operation. A two-position toggle switch selects on-line or off-line operation.

(2) Utilization. The TT-76(*)/GGC requires minor alteration for installation of the signalling device.

(3) Technical characteristics.

(a) Power requirement: 26.5 volts dc, 1.5 watts (received from TT-76(*)/GGC).

(b) Signal level: Mark 68 microamperes, space 27.5 Ma.

(c) Weight: 12 ounces.

e. Standing-Wave-Ratio Power Meter ME-165/G (TM 11-6625-333-15) (fig 4-15). The ME-165G meter is used for measuring the AN/GRC-106 radio transmitter output power and standing wave ratio. It may also be used for terminating the output during periods of radio silence.

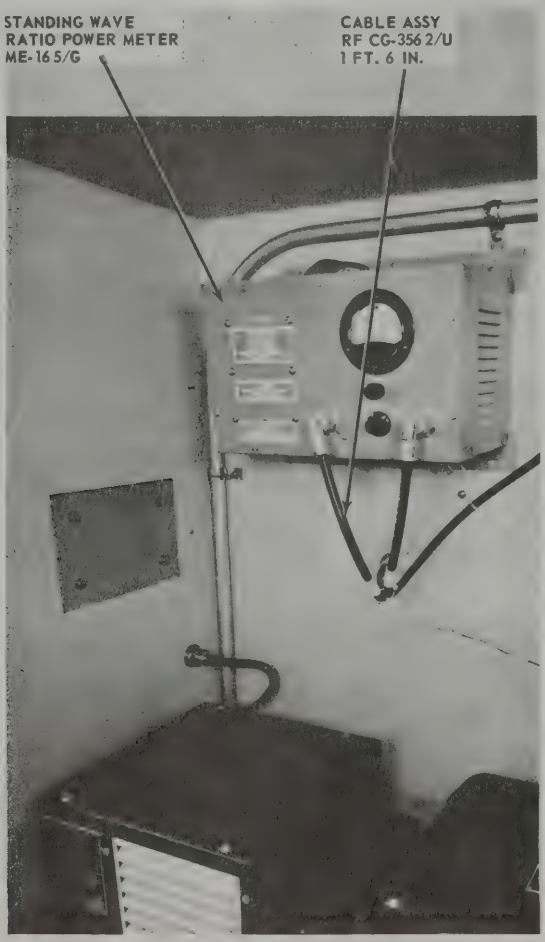


Figure 4-15. Standing-Wave-Ratio Power Meter ME-165/G.

f. Power Supply PP-4763(*)/GRC (TM 11-5820-765-12) (fig 4-16). The PP-4763(*)/GRC provides 27-29 volts dc at 50 amperes to the AN/GRC-142 shelter when an external 115 volt ac, 23 ampere, 60-Hz power source is used. The A model can also operate from a 230-volt ac, 11.5-ampere source.

Figure 4-16. Power Supply PP-4763A/GRC.

CHAPTER 5

AIRCRAFT RADIOS

5-1. GENERAL

Aircraft radios are lightweight and compact in design. Some have two major component parts, the receiver-transmitter and the control unit. Due to the weight and balance limitations of the aircraft, only the latter is located in the crew compartment. Aircraft have both basic type radios, frequency modulated (FM) and amplitude modulated (AM). Operating range for most airborne radios is 80 miles (128.7 kilometers) line of site. Army helicopters also carry an emergency rescue radio, the AN/PRC-90. Radio Set AN/PRC-41A is a ground-operated radio set designed primarily for air-to-ground communications. The aircraft found in the air cavalry troop include the Observation Helicopter OH-58A, Utility Helicopter UH-1H, and Attack Helicopter AH-1G. Each has the complete provisions for installation of Speech Security Equipment TSEC/KY-28. The standard radio configurations for the air cavalry troop helicopters, as contained in TB 750-1, are listed below:

Aircraft	Radio Equipment	
OH-58A	AN/ARC-114	VHF-FM 1
	(And complete provisions for a second AN/ARC-114	VHF-FM 2)
	AN/ARC-115	VHF-AM
	AN/ARC-51BX	UHF-AM
	(And complete provisions for an AN/ARC-116	UHF-AM)
UH-1H	AN/ARC-54 or AN/ARC-131	VHF-FM
	(And complete provisions for an AN/ARC-73	VHF-AM)
	AN/ARC-134	VHF-AM
	(And complete provisions for an AN/ARC-102	HF-AM)
	AN/ARC-51BX	UHF-AM
AH-1G	AN/ARC-131 or AN/ARC-54	VHF-FM
	AN/ARC-134	VHF-AM
	AN/ARC-51BX	UHF-AM

5-2. AIRBORNE VHF FM RADIO SETS

Airborne FM radio sets are used for air-to-air and air-to-ground communications. They will net with FM radios that have compatible frequencies such as the AN/VRC-12 and AN/PRC-77 families of radios. Secure voice operation is possible with addition of the Speech Security Equipment TSEC/KY-28.

a. Radio Set AN/ARC-54 (TM 11-5821-244-12) (fig 5-1).

Receiver-Transmitter, Radio RT-348/ARC-54

Control, Radio Set C-3835/ARC-54

Figure 5-1. Radio Set AN/ARC-54.

(1) General. The AN/ARC-54 radio has 3 operating modes: two-way voice communications, retransmission, and homing. It has two major components: Receiver-Transmitter, Radio RT-348/ARC-54 and Control, Radio Set C-3835/ARC-54. Antenna AS-1703/AR and Coupler, Antenna CU-942(*)/ARC-54 (the AH-1G helicopter uses Antenna AS-2285/ARC) are used with, but are not part of the radio set. Control, Indicator C-8157/ARC must be used in conjunction with Speech Security Equipment TSEC/KY-28 for secure voice operation.

(2) Utilization. Retransmission is accomplished by using another AN/ARC-54 radio. Homing capability is provided by using Homing Antenna AS-1922/ARC or equivalent, and Indicator ID-48A/ARN or ID-1347/ARN.

(3) Technical characteristics.

(a) Frequency range: 30.00-69.95 MHz.

(b) Number of channels: 800.

(c) Channel spacing: 50 kHz.

(d) Power output: 10 watts minimum.

(e) Power requirement: 27.5 volts dc, 206 watts.

(f) Squelch: Three-position capability:
DIS (disable)--Squelch inoperative.
CARR (carrier)--Noise operated.
TONE--150 Hz tone operated (in some installations this position is disabled).

(g) Weight:

Receiver-transmitter and mounting.	24.0 pounds
Control.	2.2 pounds
Total	26.2 pounds

b. Radio Set AN/ARC-114 (TM 11-5821-259-20) (fig 5-2).

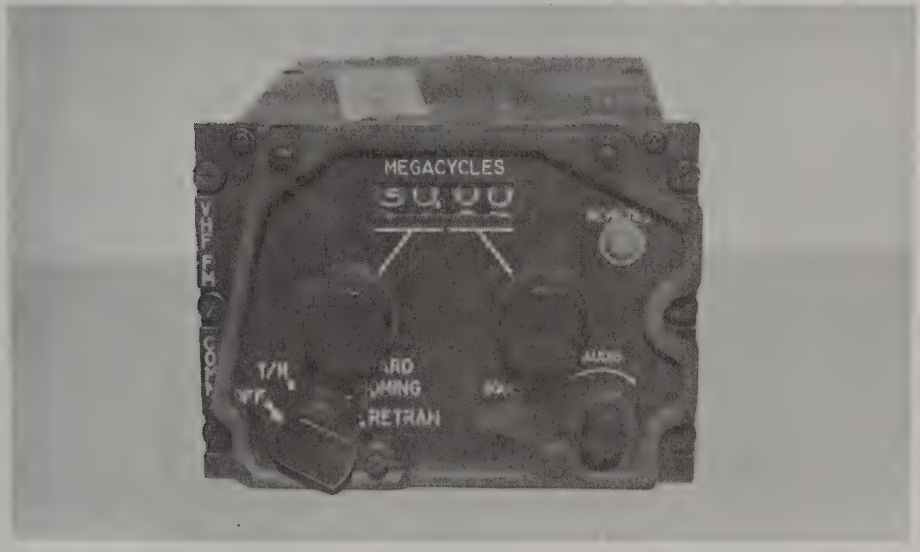


Figure 5-2. Radio Set AN/ARC-114.

(1) General. The AN/ARC-114 radio has four operating modes: two-way voice communications, two-way voice communications plus guard channel reception, two-way voice communications plus homing, and retransmission. It has only one major component.

(2) Utilization. The guard channel is received through a receiver element in the main transmitter-receiver. Homing capability is provided when used in conjunction with a 2-element homing antenna (AS-2486 and AS-2670); Network, Impedance Matching Quadrature Hybird CU-1796/ARC-114; 2 Networks, Impedance Matching CU-1794/ARC-114, and a Heading-Radio Bearing Indicator ID-1351/A. Retransmission may be accomplished using another AN/ARC-114 or either an AN/ARC-115 or AN/ARC-116 radio. The guard receiver is set within the frequency range of 40-42 MHz for 40.5 MHz.

(3) Main receiver-transmitter technical characteristics.

(a) Frequency range: 30.00-75.95 MHz.
(b) Number of channels: 920.
(c) Channel spacing: 50 kHz.
(d) Power output: 10 watts minimum high power, 1.0 watts minimum low power.
(e) Power requirement: 27.5 volts dc, 85 watts.
(f) Squelch: Noise or 150 Hz, tone operated.
(g) Weight: 7 pounds.

c. Radio Set AN/ARC-131 (TM 11-5820-670-12) (fig 5-3).

(1) General. The AN/ARC-131 radio has three operating modes: two-way voice communications, homing, and retransmission. It is the replacement for the AN/ARC-54 radio set. It has 2 major components: Receiver-Transmitter, Radio RT-823/ARC-131 and Control, Radio Set C-7088/ARC-131. Antenna AS-1703/AR and Coupler, Antenna CU-942(*)/ARC-54 (the AH-1G helicopter uses Antenna AS-2285/ARC) are used with, but are not a part of, the radio set.

(2) Utilization. Retransmission is accomplished by using another AN/ARC-131 radio. The homing capability is provided by using homing Antenna AS-1922/ARC or equivalent and Indicator ID-48A/ARN or ID-1347/ARN.

(3) Technical characteristics.

(a) Frequency range: 30.00-75.95 MHz.
(b) Number of channels: 920.
(c) Channel spacing: 50 kHz.
(d) Power output: 10 watts minimum.
(e) Power requirement: 24-29 volts dc, 110 watts.
(f) Squelch: Three-position capability.
DIS (disable)--Squelch inoperative.
CARR (carrier)--Noise operated.
TONE-- 150 Hz, tone operated (in some installations this position is disabled).
(g) Weight:

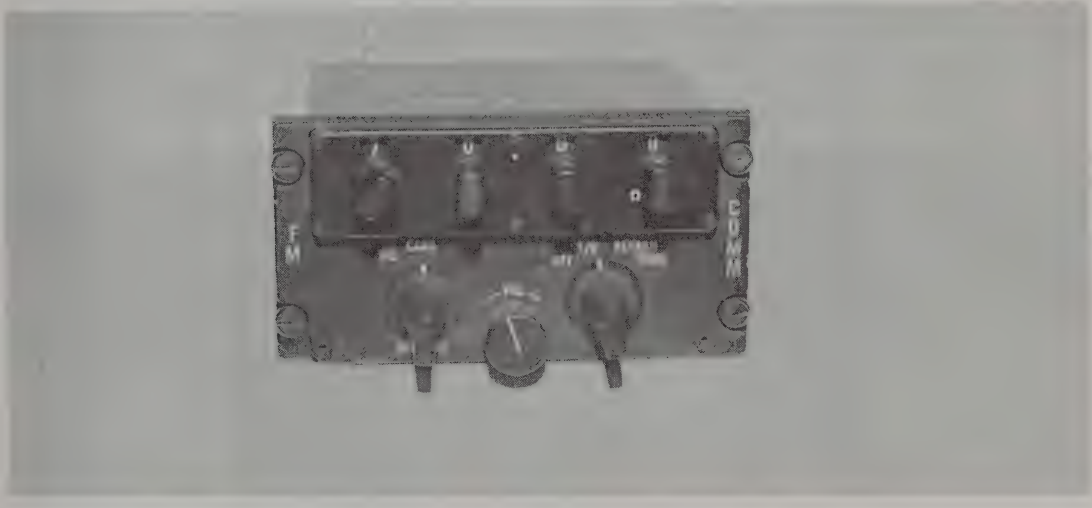
Receiver-transmitter and mounting.	26.89 pounds
Control.	2.31 pounds
Total	29.20 pounds

5-3. AIRBORNE VHF-AM RADIO SETS

Airborne VHF-AM radio sets are used for air-to-air and air-to-ground (air traffic control) communications. They do not have a secure voice capability.

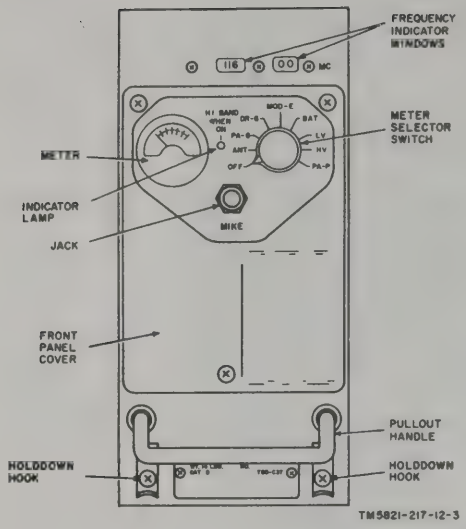
a. Radio Set AN/ARC-73 (TM 11-5821-217-12) (fig 5-4).

Receiver-Transmitter, Radio RT-823/ARC-131

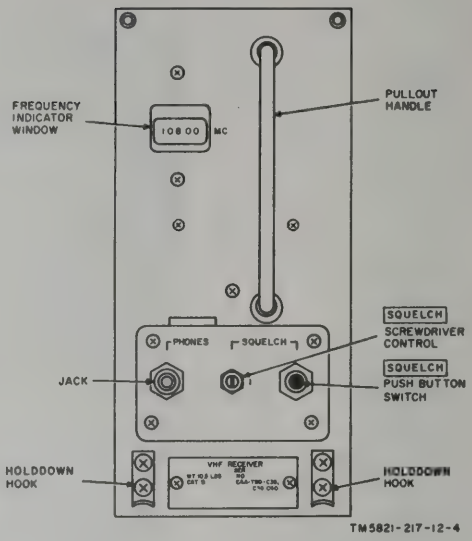


Control, Radio Set C-7088/ARC-131

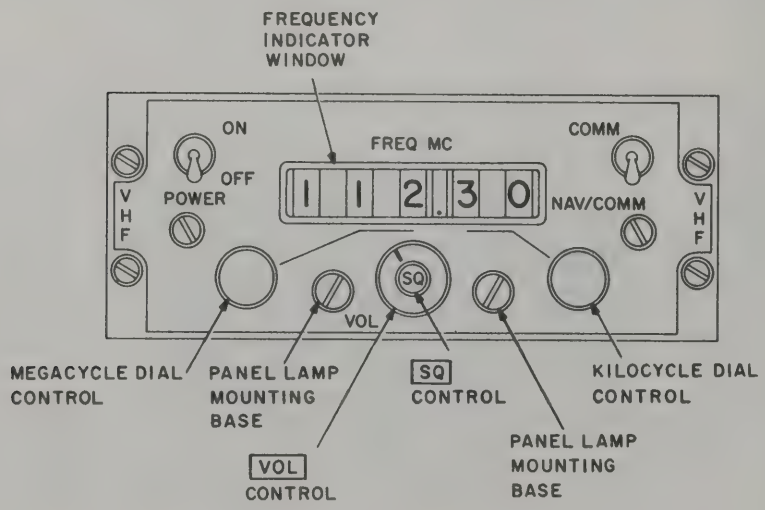
Figure 5-3. Radio Set AN/ARC-131.



Transmitter, Radio T-879(*)/ARC-73



Receiver, Radio R-1123(*)/ARC-73



Control, Radio Set C-4074(*)/ARC-73

Figure 5-4. Radio Set AN/ARC-73.

(1) General. The AN/ARC-73 has only a two-way voice communications operating mode. It can transmit and receive (not simultaneously) on different frequencies. It has three major components: Transmitter, Radio T-879(*)/ARC-73; Receiver, Radio R-1123(*)/ARC-73, and Control, Radio Set C-4074(*)/ARC-73A. Antenna AT-1108/ARC is used with, but is not a part of, the radio set.

(2) Utilization. Although some models of the control unit have a COMM-NAV/COMM toggle switch, it is not used.

(3) Technical characteristics.

(a) Frequency range: Transmitter, 116.00-149.95 MHz; Receiver, 108.00-151.95 MHz.

(b) Number of channels: Transmitter 80; Receiver 880.

(c) Channel spacing: 50 kHz.

(d) Power output: 25 watts minimum, 116-134 MHz.
20 watts minimum, 140-150 MHz.

(e) Power requirement: 27.5 volts dc, 220 watts.

(f) Squelch: Noise operated or inoperative.

(g) Weight:

Transmitter-receiver and mounting.	27.8 pounds
Control.	1.7 pounds
Total	29.5 pounds

b. Radio Set AN/ARC-115 (TM 11-5821-260-20) (fig 5-5).

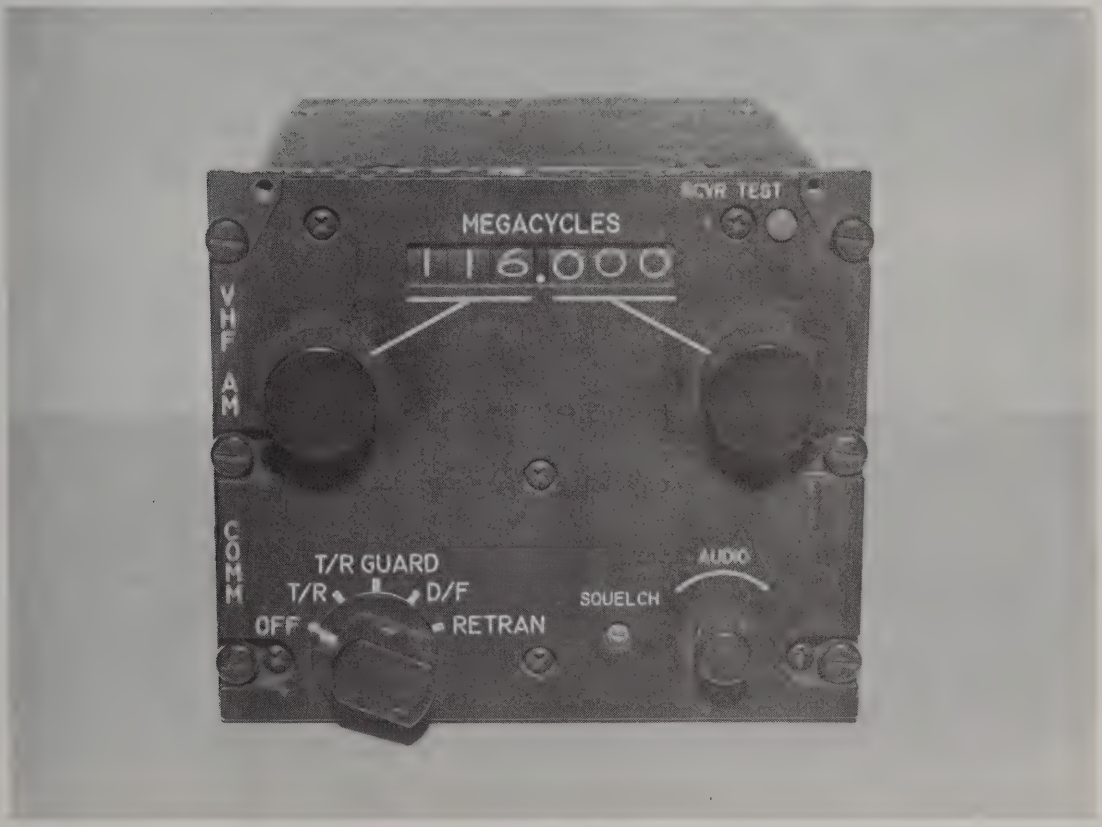


Figure 5-5. Radio Set AN/ARC-115.

(1) General. The AN/ARC-115 radio set has 4 operating modes: two-way voice communications, two-way voice communications plus guard channel reception, two-way voice communications plus homing, and retransmission. It has only one major component. A VHF antenna is used with but is not a part of the radio set.

(2) Utilization. The guard channel is received through a receiver element in the main transmitter-receiver. Homing capability is provided when used in conjunction with a homing antenna and Heading-Radio Bearing Indicator ID-1351/A. Retransmission may be accomplished using another AN/ARC-115 or either an AN/ARC-114 or AN/ARC-116 radio. The guard receiver is set within the frequency range of 119-124 MHz for 121.5 MHz.

(3) Main receiver-transmitter technical characteristics.

(a) Frequency range: 116.000-149.975 MHz.
(b) Number of channels: 1,360.
(c) Channel spacing: 25 kHz.
(d) Power output: 10 watts minimum.
(e) Power requirement: 27.5 volts dc, 85 watts.
(f) Squelch: Noise operated.
(g) Weight: 6.5 pounds.

c. Radio Set AN/ARC-134B (TM 11-5821-277-20) (fig 5-6).

(1) General. The AN/ARC-134B has only a two-way voice communications operating mode. When used with auxiliary equipment, it receives and transmits communication signals for an air traffic control signaling system. The AN/ARC-134B has two major components: Receiver-Transmitter, Radio RT-857/ARC-134 and a Control, Radio Set C-7197/ARC-134. A VHF antenna is used with, but is not a part of, the radio set.

(2) Utilization. The AN/ARC-134 and 134A models were modified to the 134B model by MWO 11-5821-277-50/1.

(3) Technical characteristics.

(a) Frequency range: 116.000-149.975 MHz.
(b) Number of channels: 680.
(c) Channel spacing: 50 kHz.
(d) Power output: 25 watts minimum.
(e) Power requirement: 27.5 volts dc, 292.5 watts.
(f) Squelch: Noise operated.
(g) Weight:

Receiver-transmitter and mounting.	17.5 pounds
Control.	2.1 pounds
Total	19.6 pounds

5-4. AIRBORNE HF-AM RADIO SET AN/ARC-102 (TM 11-5821-248-12) (Fig 5-7)

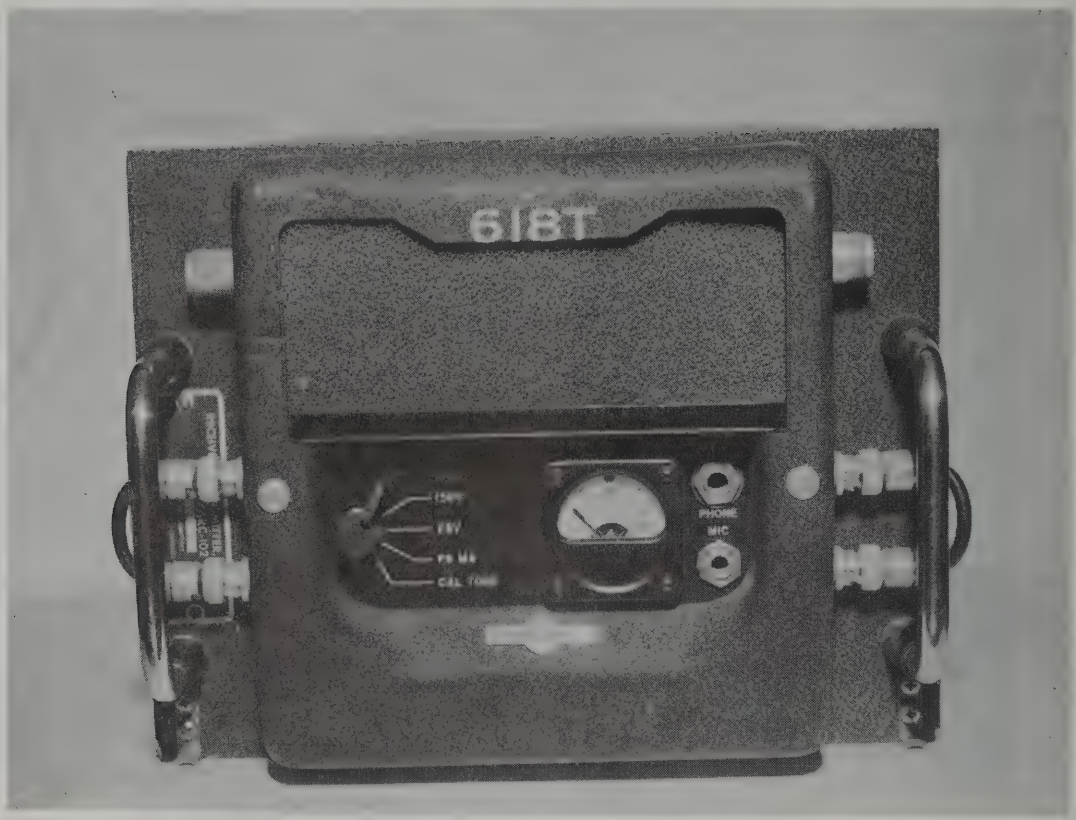
a. General. Radio Set AN/ARC-102 is used for long range, air-to-air and air-to-ground two-way voice and continuous wave (CW) communications. It operates either in the single sideband (upper or lower), AM, data (with auxiliary equipment), or CW modes. It does not have a secure voice capability. It has two major components: Receiver-Transmitter, Radio RT-698/ARC-102 and Control, Radio Set C-3940/ARC-94. A 45-foot, long wire antenna and Network, Impedance Matching CU-991/AR or CU-1658/A are used with, but are not part of, the radio set.

b. Utilization. A telegraph key, not a part of the set, is used for CW operation.

Receiver-Transmitter, Radio RT-857/ARC-134

Control, Radio Set C-7197/ARC-134

Figure 5-6. Radio Set AN/ARC-134B.



Receiver-Transmitter, Radio RT-698/ARC-102

Control, Radio Set C-3940/ARC-94

Figure 5-7. Radio Set AN/ARC-102.

c. Technical Characteristics.

(1) Frequency range: 2.000-29.999 MHz.
(2) Number of channels: 28,000.
(3) Channel spacing: 1 kHz.
(4) Power output: 400 watts, single sideband, 100 watts, CW.
(5) Power requirement: 27.5 volts dc, 952 watts.
(6) Squelch: None.
(7) Weight:

Receiver-transmitter and mounting.	63.5 pounds
Control.	2.0 pounds
Total	65.5 pounds

5-5. AIRBORNE UHF-AM RADIO SETS

Airborne UHF-AM radio sets are used for air-to-air, air-to-ground, and air-to-ship communications. They will net with any AM radios that have compatible frequencies. The air cavalry troop of the armored cavalry squadron has two AN/PRC-41A radio sets that will net with the airborne UHF-AM radios.

a. Radio Set AN/ARC-51BX (TM 11-5820-518-20) (fig 5-8).

(1) General. The AN/ARC-51 radio has 3 operating modes: two-way voice communications, two-way voice communications plus guard channel reception, and two-way voice communications plus homing. It has 2 major components: Receiver-Transmitter, Radio RT-742(*)/ARC-51BX and Control, Radio Set C-6287/ARC-51BX. The Antenna AT-1108/ARC or AS-2487 is used with, but is not a part of, the radio. The ARC-51BX is the standard UHF radio used by the Army, Air Force, and Marines. The homing capability of this radio is normally not used in Army helicopters. Only the RT-742/B model receiver-transmitter has a secure voice capability.

(2) Utilization. The guard channel (243 MHz) is received through a receiver element in the main transmitter-receiver. Homing capability is provided when used in conjunction with equipment such as Direction Finder AN/ARA-25 (not included in the standard configuration for the OH-58A, UH-1H, or AH-1G helicopters).

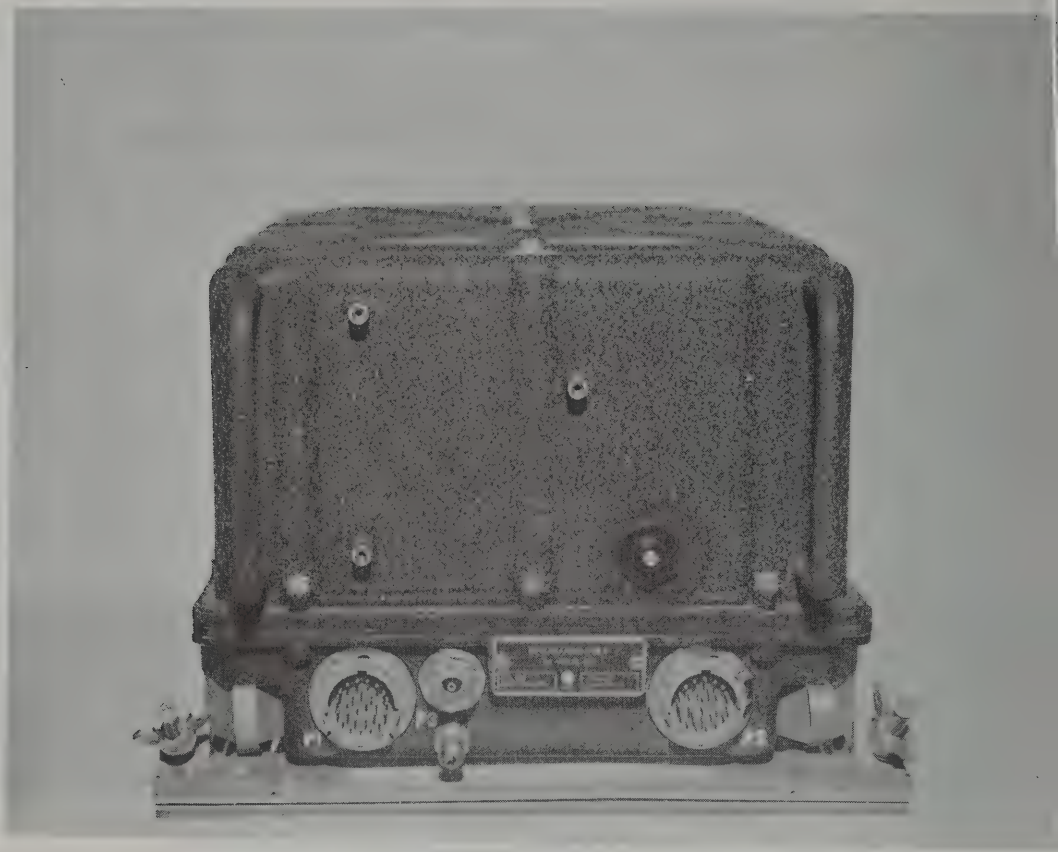
(3) Main receiver-transmitter technical characteristics.

(a) Frequency range: 225.00-399.95 MHz.
(b) Number of channels: 3,500 plus fixed guard.
(c) Channel spacing: 50 kHz.
(d) Number of presets: 20.
(e) Power output: 16 watts minimum.
(f) Power requirement: 27.5 volts dc, 336.9 watts.
(g) Squelch: Two-position capability for squelch disable.
Switch: OFF--Noise operated.
ON--Squelch inoperative.
(h) Weight:

Receiver-transmitter and mounting.	29.7 pounds
Control.	3.8 pounds
Minor components.	2.1 pounds
Total	35.6 pounds

b. Radio Set AN/ARC-116 (TM 11-5821-261-20) (fig 5-9).

(1) General. The AN/ARC-116 radio has 4 operating modes: two-way voice communications, two-way voice communications plus guard channel reception, two-way voice communications plus homing, and retransmission. It does not have secure voice capability. It has only one major component. Antenna AS-2487 is used with, but is not part of, the radio. The AN/ARC-116 radio set will replace the AN/ARC-51BX in the OH-58A helicopter, as it becomes available.



Receiver-Transmitter, Radio RT-742(*)/ARC-51BX

Control, Radio Set C-6287/ARC-51BX

Figure 5-8. Radio Set AN/ARC-51BX.

Figure 5-9. Radio Set AN/ARC-116.

(2) Utilization. The guard channel is set within the frequency range of 238-248 MHz for 243 MHz. Homing capability is provided by a homing antenna and a Heading-Radio Bearing Indicator, ID-1351/A. Retransmission may be accomplished using another AN/ARC-116, or either an AN/ARC-114 or AN/ARC-115 radio.

(3) Main receiver-transmitter technical characteristics.

(a) Frequency range: 225.00-399.95 MHz.
(b) Number of channels: 3,500.
(c) Channel spacing: 50 kHz.
(d) Power output: 8 watts minimum.
(e) Power requirement: 27.5 volts dc, 85 watts.
(f) Squelch: Noise operated.
(g) Weight: 7.75 pounds.

c. Radio Set AN/PRC-41A (TM 11-5820-510-12-1) (fig 5-10).

(1) General. Radio Set AN/PRC-41A is a portable set that can be operated in man pack, fixed station, and vehicular configurations. It has 3 modes of operation: two-way voice communications, two-way voice communications

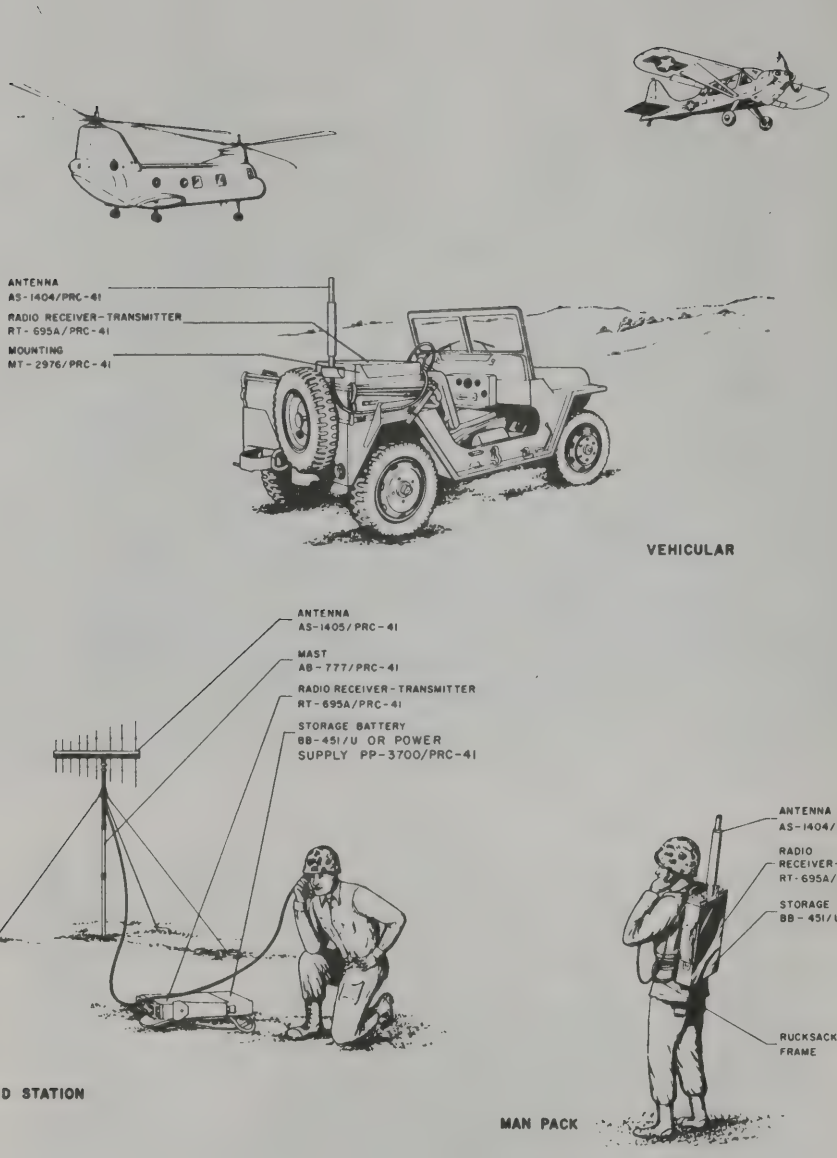


Figure 5-10. Radio Set AN/PRC-41A operating configurations.

plus guard channel reception, and retransmission. It has a secure voice capability when used with Speech Security Equipment TSEC/KY-38. It has 6 major components: Radio Set, Case CY-3883/PRC-41; Receiver-Transmitter RT-695A/PRC-41; Battery BB-451/U; Antenna, AS-1404/PRC-41 (omnidirectional); Handset H-33E/PT; harness, and frame. In addition, an Accessory Kit MK-706/PRC-41 for fixed station or vehicular configurations includes: Electronic Equipment, Case CY-3885/PRC-41; Power Supply PP-3700/PRC-41; Antenna AS-1405/PRC-41 (unidirectional, log periodic); Mast AB-777/PRC-41, power cables, antenna accessories; and a tool kit.

(2) Utilization. The guard channel (243 MHz) is received through a receiver element in the main transmitter-receiver. Retransmission is accomplished by using another AN/PRC-41A radio, and a special purpose connecting cable. The power supply can be used with a 115- or 230-volt, 50- to 400-Hz power source.

(3) Technical characteristics.

(a) Frequency range: 225.0-399.9 MHz.

(b) Number of channels: 1,750.

(c) Channel spacing: 100 kHz.

(d) Power output: 3 watts average.

(e) Power requirement: 26.5 volt dc. Man pack: Storage Battery BB-451/C (24 volts). Fixed station: Power Supply PP-3700/PRC-41. Vehicular: Vehicle battery supply.

(f) Squelch: Noise operated.

(g) Weight:

Radio set case.	79.0 pounds
Receiver-transmitter.	22.1 pounds
Accessories.	22.5 pounds
Total	123.6 pounds
Accessory Kit:	123.5 pounds

5-6. AUDIO ACCESSORIES

a. Helmet, Flying, Protective APH-5(*) and SPH-4 (TM 10-8415-202-13) (fig 5-11).

The SPH-4 is the replacement for the APH-5(*) protective helmet. The helmet shell of both is made of glass fabric bonded with hard plastic and has an energy-absorbent liner. The retractable visor provides protection from glare, wind blast, and dust. The principal communication elements are Headset H-75(*)/AIC and a dynamic, noise cancelling type microphone, M-33A/AIC.

b. Headset-Microphone H-101A/U (TM 11-5965-215-15) (fig 5-12).

The H-101A/U headset-microphone provides hand-free, low-noise communication. It is used with Cord Assembly, Electrical CX-2555/U (requires a separate transmit-receive switch) or CX-2556/U (which has an integral transmit-receive switch). Its principal elements are two H-79/AIC or H-143/AIC earphones and an IM-33/AIC microphone.

5-7. INTERCOMMUNICATION AND CONTROL EQUIPMENT

Army aircraft employ multistation intercommunication and control equipment to provide individual crew members with the ability to operate/monitor the aircraft intercommunication and radio systems. A headset-microphone, such as the H-101A/U, is required for each control set.

a. Control, Intercommunication Set C-1611D/AIC (TM 11-5831-201-20) (fig 5-13).

(1) General. The intercommunication control system, using the C-1611D control set, may consist of a maximum of 6 control sets, 8 radio receivers (including 3 navigational and 1 emergency), and 4 radio transmitters. The standard configuration for the UH-1H helicopter includes three C-1611 control sets, and the AH-1G helicopter includes 2.

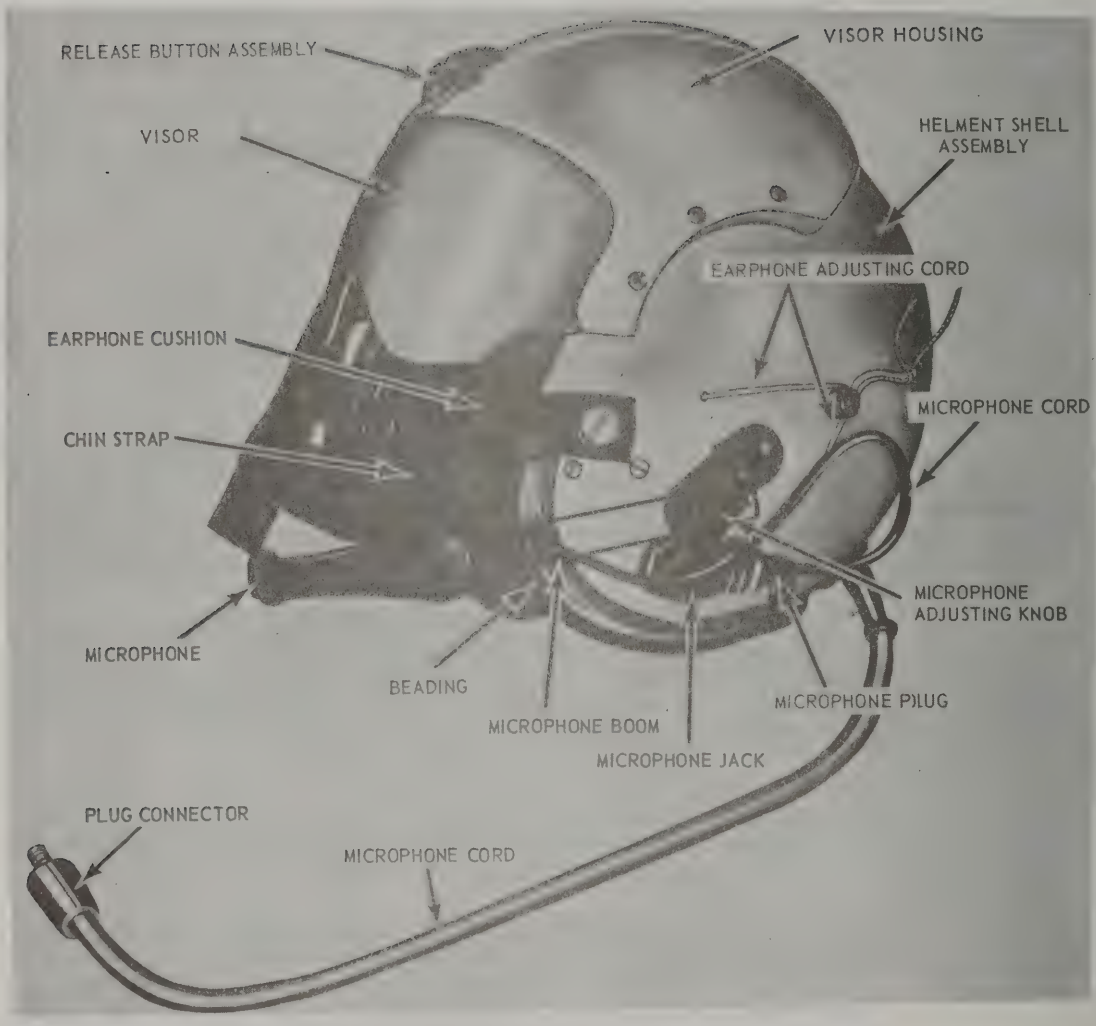
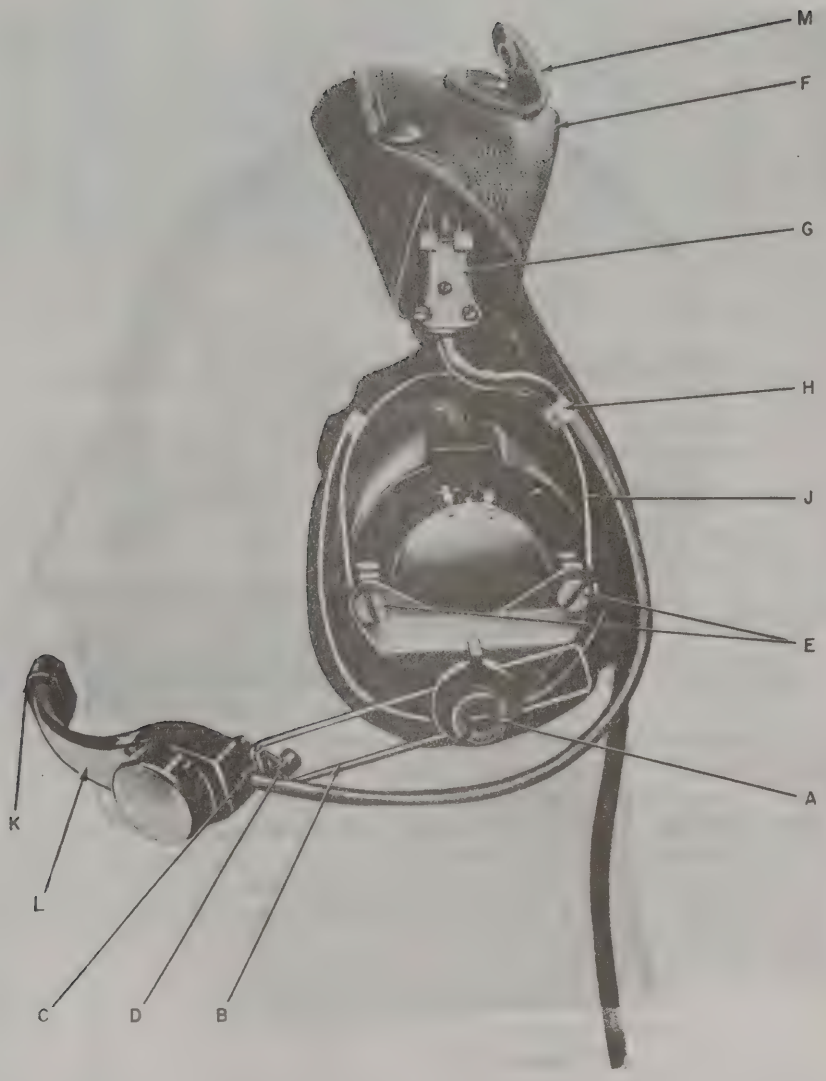


Figure 5-11. Helmet, Flying, Protective APH-5(*).



A Swivel bracket thumbnut
B Wire loop
C Friction bearing
D Slotted nut
E Screws
F Headband cover
G Connector, Plug, Electrical U-173/U
H Cable clips
J Yoke
K Microphone and nylon guard
L Microphone boom
M Stowing grommet

Figure 5-12. Headset-Microphone H-101A/U.

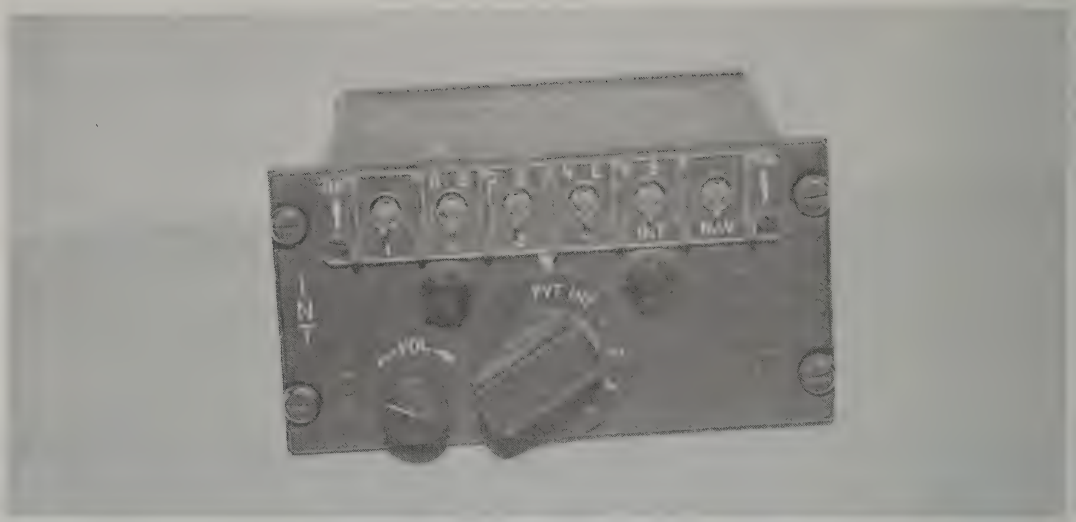


Figure 5-13. Control, Intercommunication Set C-1611D/AIC.

(2) Utilization. The C-1611 control set provides 4 possible modes of operation: Receiver monitoring, two-way voice radio, intercommunication, and private interphone (between any 2 control sets wired specifically for this type of operation). In some instances only receiver monitoring and intercommunication modes are available at a particular control set.

(3) Technical characteristics.

(a) Power requirement: 27.5 volts dc, 5.6 watts.

(b) Weight: 2 pounds.

b. Control, Communication System C-6533/ARC (TM 11-5821-262-20) (fig 5-14).

(1) General. The intercommunications control system, using the C-6533 control set, may consist of 2 or 3 control sets, 5 radio transmitters, and 8 radio receivers (including auxiliary and navigation). The control set is also capable of monitoring up to four separate audio inputs. Standard configuration for the OH-58A helicopter includes three control sets.

(2) Utilization. The C-6533 control set provides 5 possible modes of operation: receiver monitoring, two-way voice radio, intercommunication, audio monitoring, and hot microphone (a hand-free operating mode in which all speech will be applied to the intercommunication system regardless of the selector switch position).

(3) Technical characteristics.

(a) Power requirement: 27.5 volts dc, 5 watts.

(b) Weight: 2 pounds.

5-8. EMERGENCY RESCUE RADIO AN/PRC-90 (TM 11-5820-800-12) (Fig 5-15)

a. General The AN/PRC-90 is a compact, micro-electronic, AM, rescue receiver-transmitter that operates on two channels. It provides two-way voice communications over a range of 69 miles (111 kilometers) to aircraft operating at 10,000 feet altitude. It also has a beacon mode of operation (sweeps from 1,000 to 300 Hz every 2-3 seconds) at a range of 57.5 miles (92.5 kilometers) and a MCW mode (1,000-Hz tone when button is depressed).

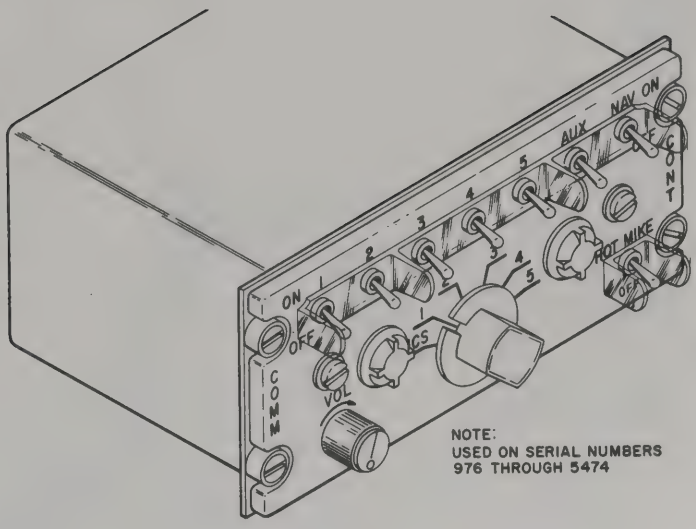


Figure 5-14. Control, Communication System C-6533/ARC.

b. Technical Characteristics.
   (1) Channel frequencies: 243.0 guard channel, and 282.8 MHz alternate channel.
   (2) Power output: 500 milliwatts.
   (3) Power requirement: Battery operated, BA-1568/U.
   (4) Weight: 24 ounces (with battery).

Figure 5-15. Radio Set AN/PRC-90.

CHAPTER 6

ELECTRONIC WARFARE (EW)

6-1. GENERAL

The term "electronic warfare" or EW refers to military actions involving the use of electromagnetic energy to determine, exploit, reduce, or prevent hostile use of the electromagnetic spectrum and all actions that retain friendly use of the electromagnetic spectrum. As armies of all nations become more dependent upon electronic devices, an understanding of EW is of extreme importance to the armor leader. Armor units, with their high density of, and heavy reliance on, communications-electronics equipment for command and control, are extremely vulnerable to enemy EW. EW includes a variety of activities (fig 6-1).

6-2. ELECTRONIC WARFARE SUPPORT MEASURES (ESM)

ESM is the information gathering aspect of EW that provides information about the enemy's electronic activities through the following techniques:

a. Interception and Monitoring. Listening to and/or recording communications for the purpose of obtaining intelligence.

b. Direction Finding. Determining the location of a transmitting station by using one or more receivers with directional antennas.

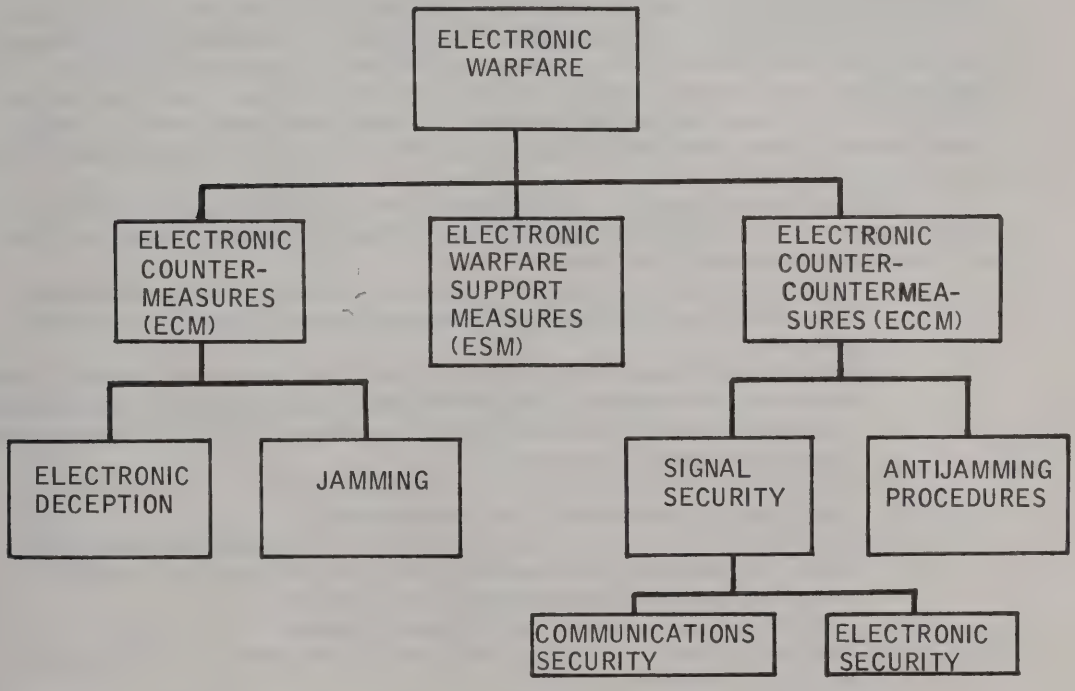


Figure 6-1. Electronic warfare activities.

c. Traffic Analysis. Examining enemy transmissions to determine tactical information, e.g., unit size, condition, and future plans.

d. Cryptanalysis. Decoding enemy messages to learn their content.

6-3. ELECTRONIC COUNTERMEASURES (ECM)

ECM is the offensive weapon of EW that includes actions taken to prevent or reduce the enemy's effective use of his communications-electronics systems. This is primarily accomplished by:

a. Electronic Jamming. Electronic jamming is deliberately transmitting on the enemy's operating frequency with sufficient power to mask his signal. Jamming is usually conducted by an Army Security Agency unit since it has the specialized equipment and trained personnel to conduct ECM. Electronic jamming is further subdivided into communications and noncommunications jamming.

(1) Communications jamming (COMJAM) is electronic jamming used primarily against radio and wire communications systems.

(2) Noncommunications jamming is electronic jamming used against electronic devices other than those that are used as a means of communications, e.g., navigational aids, radars, guided missiles, proximity fuses, and similar devices.

b. Imitative Deception. Imitative deception is the introduction of fraudulent or misleading messages into the enemy's communications system with the purpose of having the enemy accept these messages as his own.

6-4. ELECTRONIC COUNTER-COUNTERMEASURES (ECCM)

ECCM includes those measures that we take to defend our system from the offensive EW activities of the enemy. At the operational level, ECCM is perhaps the most important of the three main subdivisions of EW. It is at this level that we find the personnel who operate the systems that are vulnerable to the enemy's EW operations. And it is here that the responsibility for countering the EW attacks of the enemy rests most heavily. ECCM at platoon through brigade level deals primarily with the employment of proper signal security and antijamming techniques.

a. Communications Security. Communications security includes all measures designed to deny or delay unauthorized persons from gaining information of value from the study of telecommunications. It includes:

(1) Using authentication to ensure that the station you are communicating with is an authorized one and using only approved codes to hinder enemy cryptanalysis.

(2) Assigning and changing frequencies and call signs in a manner intended to deny the enemy information regarding identification and disposition of tactical units.

(3) Employing radio silence by designating a period during which all radio communications equipment is turned off.

(4) Employing listening silence by restricting the use of the radio transmitter and only permitting monitoring of the radio receiver.

(5) Enforcing net discipline and ensuring the use of proper radiotelephone procedures. All stations operating within a net must use authorized prosigns, prowords, and limit transmissions to official traffic.

(6) Using speech security equipment whenever possible.

(7) Selecting radio sites that have a hill mass or other obstacle between them and the enemy location.

b. Electronic Security. Electronic security includes measures designed to deny unauthorized persons information of value from our noncommunications electromagnetic radiation devices, e.g., radar. Radar security measures include:

(1) Reduced power operation. Operation should be conducted with minimum power required for satisfactory operation. Use a dummy antenna during maintenance and alignment operations.

(2) Proper siting. Radar transmitters should be deployed to provide for side lobe absorption and proper target background when possible. Orient radar beam away from suspected enemy intercept sites.

(3) Restricted operation. Operate radar equipment only when necessary to support the tactical mission.

c. Antijamming Procedures. Antijamming procedures are employed by radio operators to reduce the effects of enemy jamming. They are:

(1) Recognition. The first thing an operator should do when his equipment indicates some type interference is to attempt to determine what is causing the interference. The operator cannot immediately assume that it is jamming, because the symptoms of jamming are often similar to those of other types of radio or radar interference. One technique is the removal of the receiver antenna to determine whether a signal is being generated internally by the receiver. If the interference decreases noticeably with the antenna removed, then the interference is being generated externally.

(2) Continued operation. Radio operations should always be conducted in a normal manner once jamming has been identified so that the enemy cannot determine the effect of his jamming activities. The rule to follow is: Whenever experiencing jamming, continue operations unless ordered to shut down.

(3) Reporting. All equipment operators have a requirement to report jamming to their next higher headquarters. This report should be sent by a supplemental means of communications, e.g., wire or messenger. A jamming report should contain, as a minimum: the date and time of the jamming, frequencies affected, type and strength of the jamming signal, and designation of the unit making the report.

CHAPTER 7

ANTENNAS

7-1. GENERAL

The antenna of a radio transmitter or receiver either radiates energy into space or receives energy from space. This energy, in the form of radio or electromagnetic waves, is generated by the transmitter and fed to the antenna by means of a special transmission line. The transmitting antenna radiates this energy out into space at the speed of light. A receiving antenna, when placed in the path of the moving waves, absorbs part of the electromagnetic energy and transfers it to the receiver, also by means of a transmission line. The same antenna that radiates electromagnetic energy is, in most cases, also used to receive it. However, an antenna cannot radiate and receive energy simultaneously. Armor units employ several types of antennas for vehicular, portable, or field operation.

a. Vertical Antennas. A vertical antenna is any antenna that is positioned perpendicular to the ground, such as the vertical whip antenna mounted on a vehicle. Vertical antennas may be placed on top of antenna masts. The purpose of using a mast is to raise the antenna element higher for improved transmission and reception or increased operating range. Vertical antennas radiate and receive signals equally in all directions. Because of this characteristic, other stations operating on the same or adjacent frequencies may easily interfere with the desired signal and make reception difficult or impossible.

b. Horizontal Antennas. A horizontal antenna is any antenna that is positioned or suspended parallel to the ground. This type of antenna radiates and accepts maximum radiation either broadside or along its length. This characteristic makes the horizontal antenna a directional antenna.

c. Siting. A radio station must be located in a position that will assure communications with all other stations with which it is to operate.

(1) Range. When selecting a radio site the first factor that must be considered is the operating range of the radio-antenna system. The site must be within operating range of the distant station(s) and vice versa. The operating range depends upon many factors and varies with the type equipment employed. Operating ranges for FM radio-antenna systems are listed in paragraph 7-11.

(2) Line of site (LOS). The requirement for LOS is particularly critical when operating at frequencies above 30 MHz. In most cases it is not necessary to make a map profile to determine the LOS condition but a good rule to follow is: select the highest ground possible in the assigned area. You can take advantage of the LOS characteristic of tactical FM radios by selecting a site where high ground serves as a shield to prevent the enemy from intercepting or interfering with your transmissions.

(3) Obstacles. Obstacles can be both natural and man-made. Hills and mountains will limit operating range. In hilly terrain, positions relatively high on the slopes should be selected. Depressions, valleys, and low terrain are poor for radio transmission and reception. Trees with heavy foliage absorb radio waves. Leafy trees have a more adverse effect than evergreens. The antenna should be kept clear of all foliage and dense brush. Wet foliage can short out the antenna and prevent operation. Steel and reinforced concrete structures hinder transmission and reception. Radio sites should be selected away from power or telephone lines, generators, and heavily traveled roads. Faulty vehicle ignition systems may cause electrical interference.

d. Safety Measures. Damage to equipment, serious injury, and even death have resulted because personnel have failed to observe antenna safety precautions.

(1) Whip antenna precautions:

(a) Do not touch the antenna when the transmitter is operating.

(b) Check for clearance before passing under power lines.
(c) Tie antenna down when mobile, unless optimum operation is necessary.

(2) Antenna mast precautions:
(a) Install no closer to a power line than twice the antenna height.
(b) Place guy lines away from power lines.
(c) Check guy lines for worn spots, frays, or other defects.

e. Maintenance. To facilitate separating antenna sections and to prevent the sections from locking together (seizing) due to corrosion, use graphite grease (FSN 9150-753-4648). Clean the threads of the antenna sections and antenna elements. Put a thin coat of the graphite grease on the threads of the male antenna sections and elements (do not put the grease on the female sections and elements) before assembly.

7-2. WHIP ANTENNAS (Fig 7-1)

The most common antenna used for tactical radio communications when relatively short distances are to be covered is the whip antenna. This term is applied to almost any type of flexible antenna used in conjunction with portable or vehicular radio equipment. Whip antennas, ranging in length up to 15 feet, are mounted on vehicles. Shorter whip antennas are mounted on small, hand-held radio sets, or portable sets used in the field. A whip antenna mounted on a vehicle may be left fully extended so that the radio set can be used instantly while the vehicle is in motion. If the antenna hits an obstruction, a flexible mast base will usually prevent the antenna from breaking or being bent, since most of the bending occurs at the mast base. The mast base also allows the whip antenna to be held in a nearly horizontal position by an insulated guy lines so that the vehicle can be driven under low bridges or obstructions without making contact. The operating range under these conditions is reduced.

7-3. ANTENNA AS-1729/VRC (TM 11-5985-262-15) (Fig 7-1)

Antenna AS-1729/VRC is a 2-piece, 10-foot, center-fed, whip antenna designed for operation between 30-76 MHz. It is used primarily with the AN/VRC-12 and AN/PRC-77 families of radios. It uses a matching unit, MX-6707/VRC, which operates automatically when used with the AN/VRC-12 family receiver-transmitters. It can also be operated manually to 10 different frequency band segments.

7-4. WHIP ANTENNA EXPEDIENTS

a. Immediate Actions. If radio communication is lost because of a damaged defective antenna system, there are several immediate actions that can be performed:

(1) Switch antennas. To instantly restore communications when using a radio set that has an auxiliary receiver, such as the AN/VRC-12, connect the auxiliary receiver antenna to the receiver-transmitter. The auxiliary receiver antenna will work as a transmitting antenna over a reduced operating range.

(2) Field Wire WD-1/TT. For example, to retain the capability of your auxiliary receiver, if you have connected its antenna to the receiver-transmitter, connect a 6-8-foot length of field wire to the antenna connector on the auxiliary receiver and throw it out the loader's hatch. This will provide limited range operation.

(3) Switch equipment. If the situation and time permits, antenna or radio equipment can be switched within the organization to keep the unit commander in communication with his subordinates and the next higher echelon at all times.

b. Expedients.

(1) When a whip antenna is broken and a replacement is not immediately available, it is possible to improvise a satisfactory antenna by using field wire (fig 7-2)

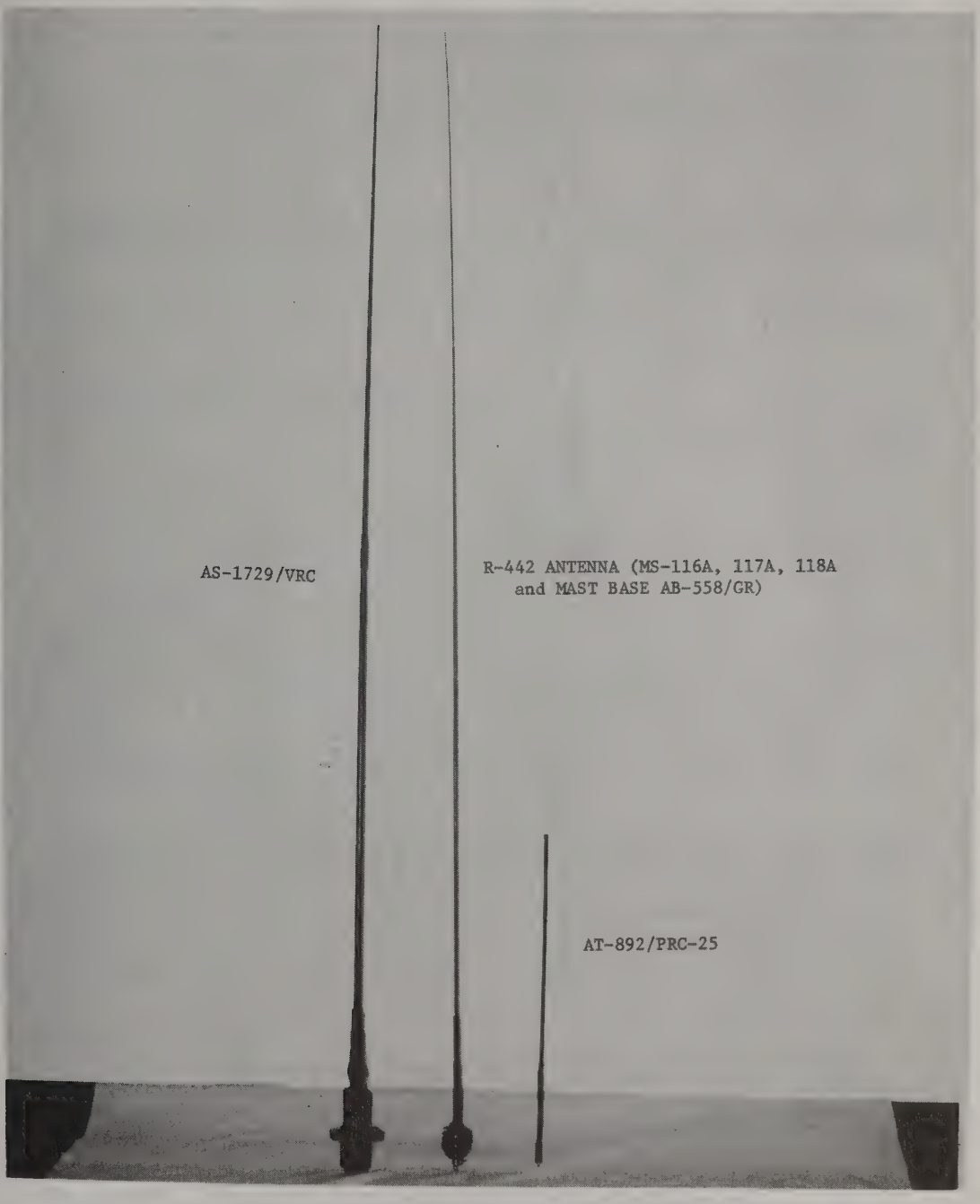


Figure 7-1. Whip antennas.

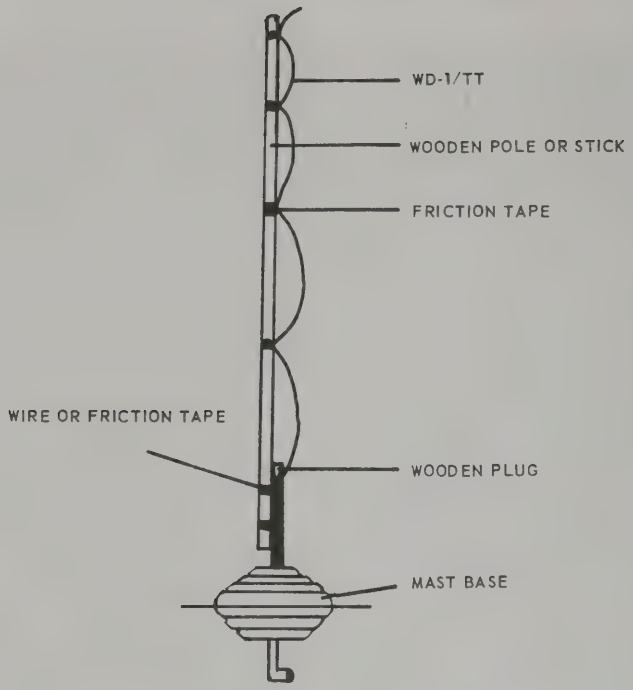


Figure 7-2. Field expedient whip antenna using wire WD-1/TT.

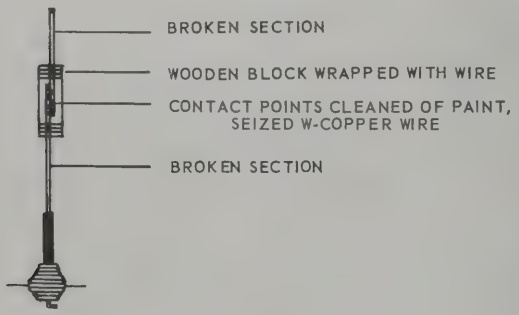


Figure 7-3. Repair of standard whip antenna.

or to repair a broken antenna by lashing together the broken antenna pieces (fig 7-3). When fabricating a whip antenna, using Wire WD-1/TT, the length of wire should be as near as possible to the original length of the whip antenna. One end of the wire is bared by removing the insulation. This end is then inserted into the top of the mast base and secured by a small wooden plug. A wooden stick is taped or wired to the mast base to serve as support for the

wire that is taped to the stick. This antenna will generally provide a satisfactory operating range until a replacement can be obtained.

(2) To repair a broken whip antenna for emergency use, the two broken sections of the antenna are first cleaned of paint at the contact point, then wired together with copper wire (obtained from Wire WD-1/TT). This seizes the contact and provides a good electrical connection. A stick is then wired to the antenna to serve as a splint and support the broken antenna sections. This antenna will generally provide satisfactory operation until replacement sections can be obtained.

7-5. ANTENNA EQUIPMENT RC-292 (TM 11-5820-348-15) (Fig 7-4)

Antenna Equipment RC-292 is used to extend the operating distance of the AN/PRC-25/77 (12 miles-19 kilometers) and AN/VRC-12 (36 miles-58 kilometers) families of radios. It is a wide band, ground plane, whip antenna with a 30-foot mast assembly. Its frequency range is 20 to 76 MHz. The antenna elements are preadjusted to the appropriate operating lengths for a given frequency by assembling from 2 to 4 mast sections.

7-6. EXPEDIENT GROUND PLANE ANTENNA (Fig 7-5)

When Antenna Equipment RC-292 is not available for extending the range of FM tactical radios, an expedient can be used. The expedient ground plane antenna is constructed as follows:

a. Cut a length of wire to 1/2 the length calculated by the 1/2 wave formula: Length (feet) = 468/frequency (MHz) or length (meters) = 142/frequency (MHz). This will provide the length for the required quarter-wave whip radiating element.

b. The reflectors are cut from three pieces of wire approximately the same length as the radiating element and joined together at one end.

c. Three sticks approximately the same length as the radiating element are tied together to form a triangular support for the lower end of the reflector elements.

d. Cut a piece of Field Wire WD-1/TT long enough to reach from the radio to the desired height of the antenna. Splice one conductor of this wire to the reflectors and the other conductor to the radiating elements. Strip the insulation from the other end of this wire and ground one conductor to the radio set and place the other conductor into the center of the antenna connector. If communication is not satisfactory, reverse these connections.

e. Suspend the antenna. Attach a rope to the insulator on the top end of the radiating element. Toss the rope over a tree limb and pull the antenna up to the desired height.

7-7. ANTENNA GROUP AN/GRA-50 (TM 11-5820-467-15) (Fig 7-6)

Antenna Group AN/GRA-50 is a horizontal, doublet antenna assembly used for radio operation in the 1.5-2.0-MHz band. It can be used with any radio set with a transmitter power output of less than 100 watts, but is primarily employed with Radio Set AN/GRC-106 to increase its operating range and reliability. In addition to the components shown in figure 7-7, the AN/GRA-50 antenna also includes a canvas carrying bag and a feet-frequency calibrated tape measure.

7-8. EXPEDIENT DOUBLET ANTENNA (Fig 7-7)

An expedient doublet antenna can be made from Field Wire WD-1/TT. The length of the antenna can be calculated using the formula in paragraph 7-6a. Each side should be 1/2 of the calculated length to provide the complete doublet (1/2 wave) antenna. Any usable nonconductor such as glass, plastic, or wood may be used for insulators.

7-9. ANTENNA AT-984A/G (Fig 7-8)

Antenna AT-984/G is a 150-foot, long wire, end-fed, multiple wavelength directional antenna that is used with the AN/PRC-25/77 families of radios to increase their operating range.

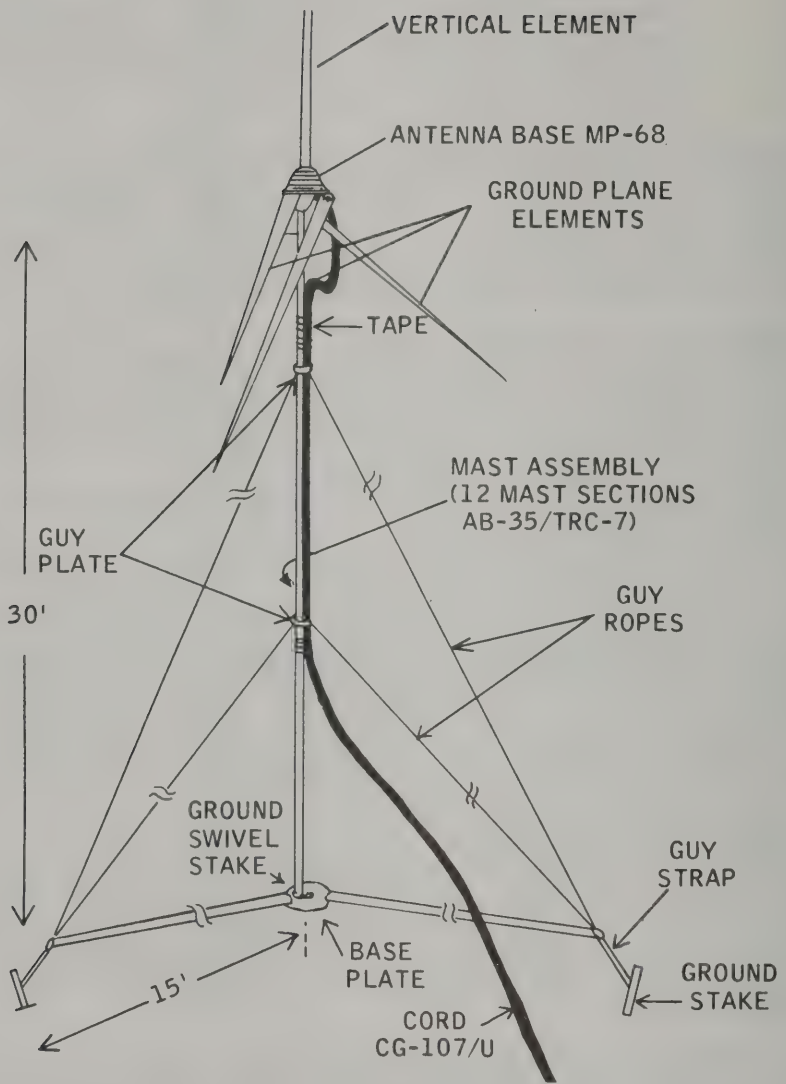


Figure 7-4. Antenna Equipment RC-292.

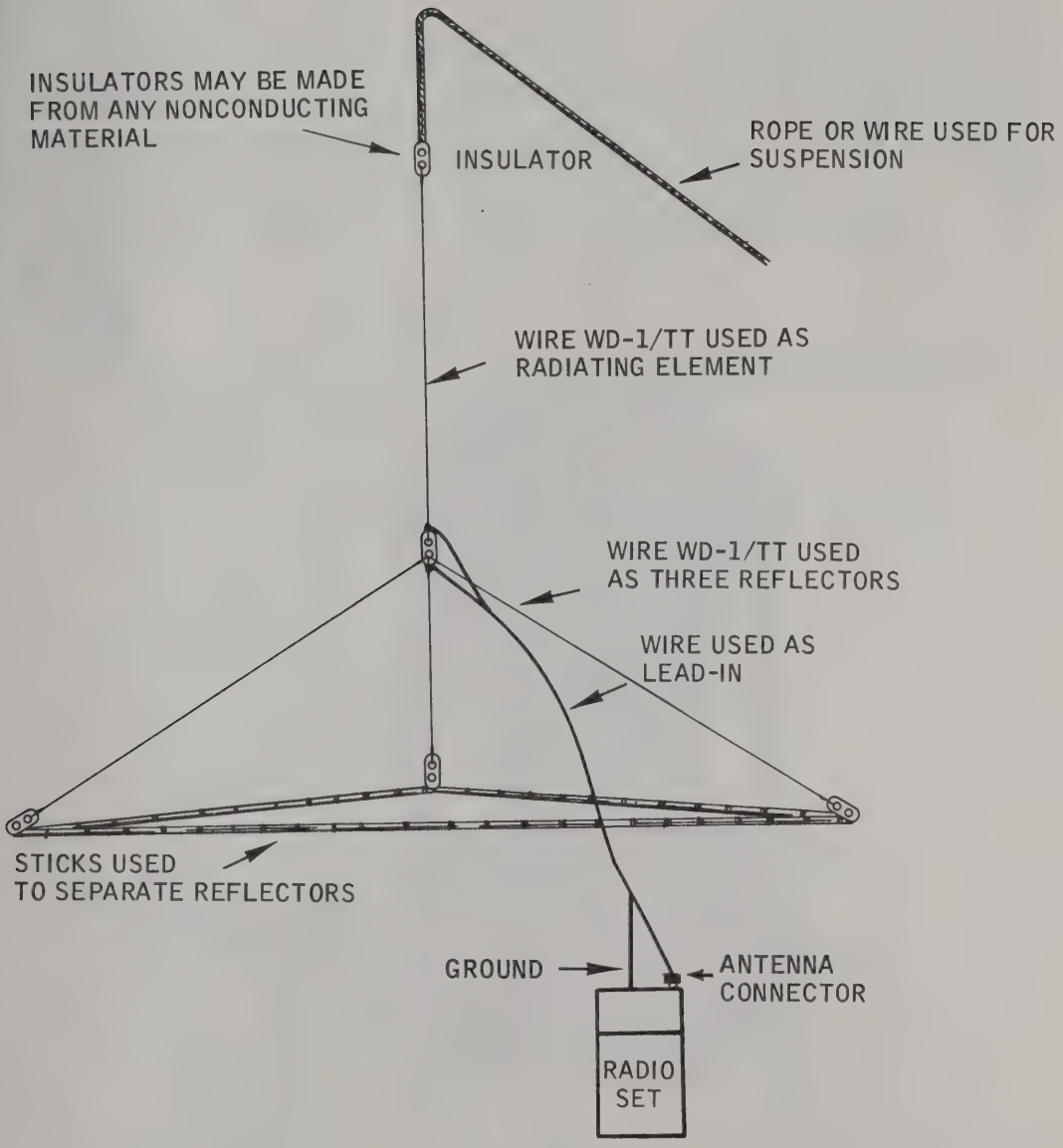

INSULATORS MAY BE MADE FROM ANY NONCONDUCTING MATERIAL
INSULATOR
ROPE OR WIRE USED FOR SUSPENSION
WIRE WD-1/TT USED AS RADIATING ELEMENT
WIRE WD-1/TT USED AS THREE REFLECTORS
WIRE USED AS LEAD-IN
STICKS USED TO SEPARATE REFLECTORS
GROUND
ANTENNA CONNECTOR
RADIO SET

Figure 7-5. Expedient ground plane antenna.

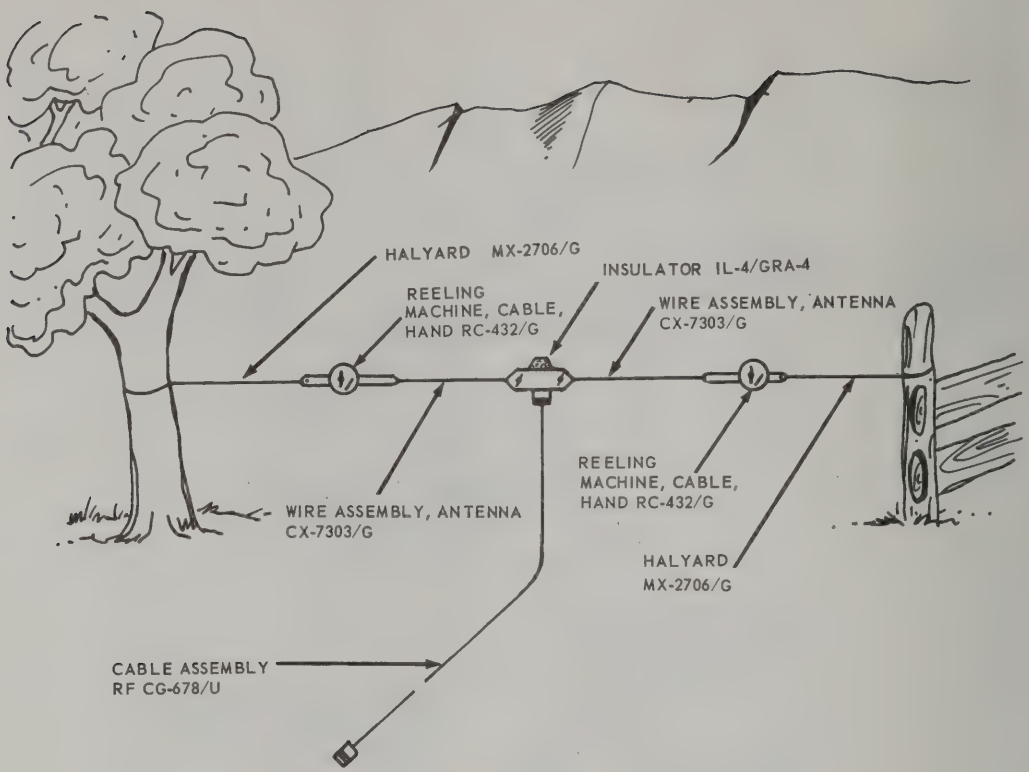


Figure 7-6. Antenna Group AN/GRA-50.

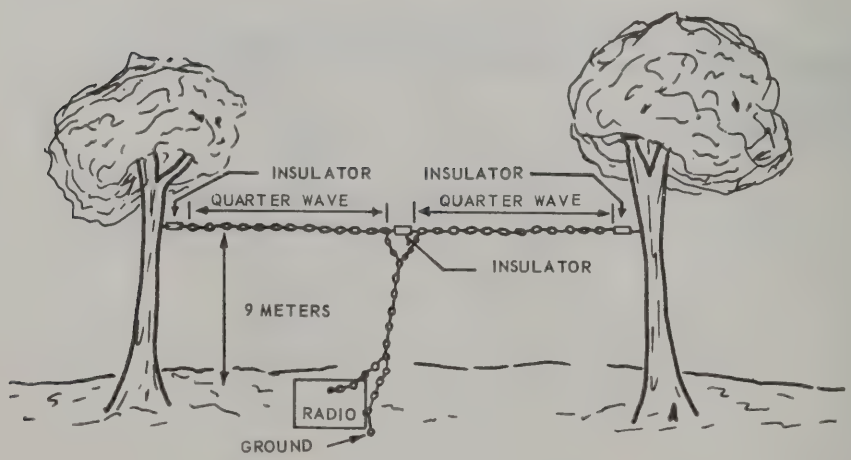


Figure 7-7. Expedient doublet antenna.

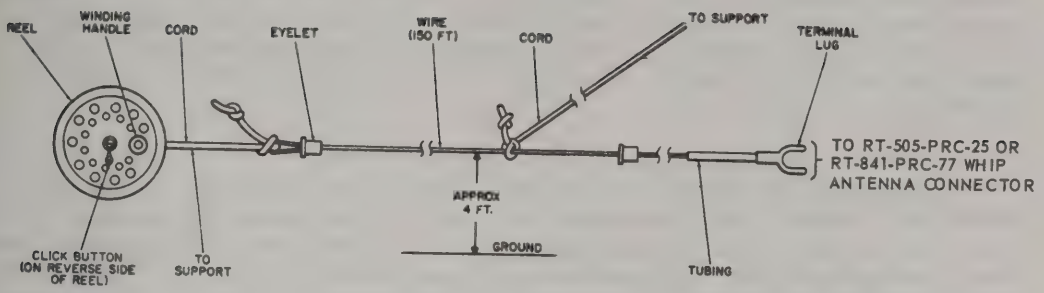


Figure 7-8. Antenna AT-984A/G.

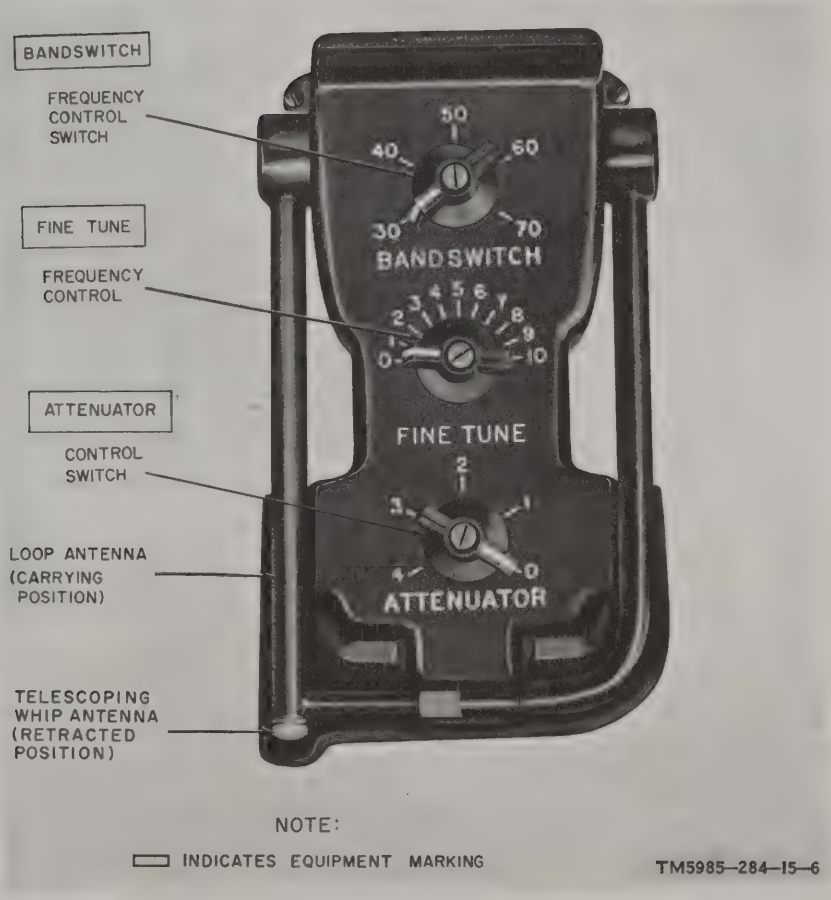


Figure 7-9. Antenna Loop AT-784/PRC.

Transmission and reception with a long wire antenna is off the end of the antenna in the direction away from the radio set. The terminal lug is connected to the antenna connector on the radio by using the antenna support. The AT-984 antenna is equipped with a canvas carrying bag. It does not have a separate reference publication but instructions for its use are contained in paragraph 6-5 of both TM 11-5820-398-12 (AN/PRC-25) and TM 11-5820-667-12 (AN/PRC-77).

7-10. ANTENNA LOOP AT-784/PRC (TM 11-5985-284-15) (Fig 7-9)

Antenna Loop AT-784/PRC is a compact homing antenna designed for use with the AN/PRC-25/77 and AN/VRC-12 families of FM radios. The loop antenna is combined with a two-section extendable whip sensing antenna to provide a directional reception pattern. This pattern permits determination of the general (within several degrees) direction to an operating radio transmitter. The frequency band of the AT-784 antenna is 30-76 MHz. Proper siting is particularly important for the AT-784. For best results, this antenna should be operated away from obstructions such as large buildings, bridges, steel structures, or hills, and possible sources of electromagnetic interference such as high power or telephone lines. It can be used only for reception.

7-11. ANTENNA REFERENCE DATA

RADIO	OPERATING FREQUENCY (MHz)	ANTENNA NOMENCLATURE	ANTENNA TYPE	ANTENNA LENGTH (Ft/M)	OPERATING RANGE (Miles/Km)
Receiving Set AN/PRR-9	47-57	AS-1998/PRR-9	Stainless steel, flexible wire, whip	1.5/0.4	w/PRT-4 Channel 1, 1.0/1.6 Channel 2, 0.3/0.5
Transmitting Set AN/PRT-4	47-57	AS-1999/PRT-4	Collapsible tubular, whip	2.0/0.6	w/PRR-9 Channel 1, 1.0/1.6 Channel 2, 0.3/0.5
Radio Sets AN/PRC-25 AN/PRC-77	30-76	AT-892/PRC-25	Semirigid, steel tape, whip	3.0/0.9	3.0/4.8
		AT-271A/PRC (w/support, Antenna AB-591/PRC-25)	Six-section, tubular folding whip	10.0/3.0	5/8
		RC-292	Ground plane whip	41.5/12.6 with 30.0/9.1 mast	12.0/19.2 to RC-292 8.0/12.8 to whip
		AT-984/G	Horizontal, long wire	150/45.7	17.5/28.0 to AT-984/G 12.0/19.2 to whip
Radio Sets AN/VRC-53 AN/GRC-125 AN/VRC-64 AN/GRC-160	30-76	AT-1729/VRC* (para 7-3) (Top AT-1095/VRC, Bottom AT-1730/VRC and Matching Unit Base, Antenna MX-6707/VRC)	Two-section, center-fed, rigid, fiberglass, whip	9.5/2.9	5/8

*AT-1729/VRC replaces AT-912/VRC, a two-section, rigid, fiberglass, whip (bottom AT-1095/VRC, top AT-1096/VRC, w/Antenna Matching Unit MX-2799/VRC and Base Antenna Support AB-719/VRC).

RADIO	OPERATING FREQUENCY (MHz)	ANTENNA NOMENCLATURE	ANTENNA TYPE	ANTENNA LENGTH (Ft/M)	OPERATING RANGE (Miles/Km)
Radio Sets AN/VRC-12, -46, -47, -49	30-76	For receiver-transmitter: AT-1729/VRC* (see above)	Two-section, center-fed, rigid fiberglass, whip	9.5/2.9	Low power 10/16 High power 30/48
		For receiver: whip antenna (Bottom MS-116A, Middle MS-117A, Top MS-118A, w/Mast Base AB-558/GR)	Three-section, tubular, rigid whip	11/3.3	
		RC-292	Ground plane whip	(see above)	36.0/57.6 to RC-292 25.0/40.0 to whip
Radio Set AN/GRC-106 and Radio Teletypewriter Set AN/VSC-3	2-30	Antenna Group GRA-50 (para 7-7) or	Horizontal doublet	150/45.7	Sky wave 100-1,500/161-2,213
		Whip Antenna (Bottom, three MS-116A's; middle, MS-117A; top, MS-118A, w/Mast Base AB-652/GR)	Five-section, tubular, rigid whip	15/4.6	Ground wave 50/80

CHAPTER 8

WIRE COMMUNICATIONS EQUIPMENT

8-1. GENERAL

Normally wire is one of the most dependable communications means. Although radio is the primary means of communications in armor units, the use of wire is not only desirable but, under certain conditions, absolutely essential. The decision to establish wire communications depends upon the situation and the time available to install and use it.

a. Advantages of Wire Communications.

(1) Wire communications affords person-to-person conversation with break-in operation. Break-in operation refers to the capability of the persons conversing to interrupt one another without waiting until a transmission is completed.

(2) Wire is a more secure means of communications than radio. However, it does not ensure complete security of information transmitted in the clear because it is susceptible to enemy monitoring devices.

(3) Field wire communications equipment has a low power requirement, generally operating on low voltage dry cell batteries.

b. Disadvantages of Wire Communications.

(1) Installing a wire system is time-consuming; however, this time may be reduced through the use of properly trained personnel and efficient planning of the system before installation. The length of the line, method of laying it, type of terrain, and weather are the primary factors that affect installation time.

(2) Wire lines are susceptible to breakage by vehicular traffic and artillery fire, and they require periodic maintenance. Care should be taken in selecting installation sites and wire routes that will minimize breakage.

(3) Wire lines are inflexible. Since all terminals must be physically connected, wire communications are not practical for highly mobile operations. Wire communications are most suited for defensive type operations and within command posts, but it can be employed in any tactical operation if its use is planned properly.

c. Authorization. Armor units are authorized by TOE a variety of wire communications equipment, including: field wire, wire laying and recovery equipment, manual switchboard, sound powered and battery operated telephones, and teletypewriter equipment.

8-2. FIELD WIRE (Fig 8-1)

Two-conductor, twisted pair, Field Wire WD-1/TT is the type field wire presently used by armor units. It has flexible conductors, high tensile strength, good conductivity, and weatherproof insulation. Each of the 2 conductors has 4 copper strands for conductivity and 3 steel strands for tensile strength. The minimum tensile strength of each conductor is 85 pounds. The weight of the twisted pair wire is 30 pounds per kilometer (48 pounds per mile). The insulation is polyethylene with an outer layer of nylon. The communication range varies with the terminal equipment used and other factors such as weather, method of installation, condition of wire, and number of splices.

a. Wire Splices. Splicing is a method used to join the conductors of field wire lines to maintain electrical continuity. A good splice should have the same tensile strength, electrical conductivity, abrasion and weather protection, and insulation resistance as the unspliced part of the wire. A poorly made splice introduce transmission loss, increases noise, and generally impairs the quality of the circuit. A standard field wire splice is made using

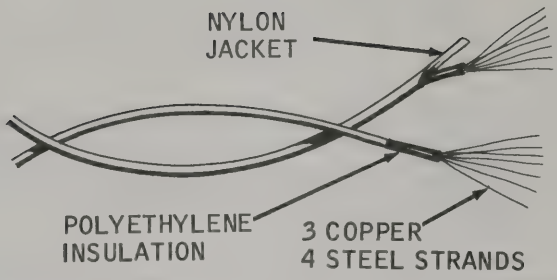


Figure 8-1. Field Wire WD-1/TT.

Splicing Kit, Telephone, Cable MK-356/G. This kit is organic to signal, engineer, and artillery units in the armored division. An expedient field wire splice can be made using Tool Equipment, TE-33 (fig 8-2).

b. Tool Equipment TE-33 (fig 8-2). Tool Equipment TE-33, is an expendable item authorized for issue on the basis of one per field wireman, switchboard, and remote control equipment. Field wiremen (MOS 36K) are assigned to the headquarters' communications element of the tank battalion, armored cavalry squadron, and armored brigade.

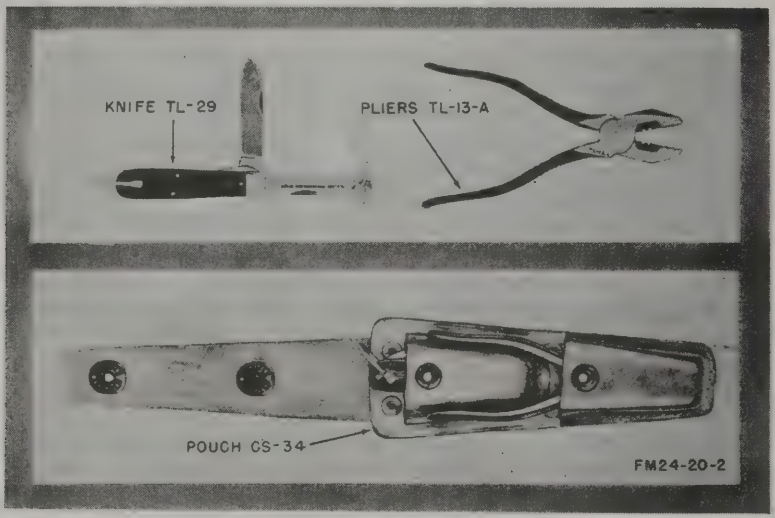


Figure 8-2. Tool Equipment TE-33.

c. Construction of an Expedient Field Wire Splice.

(1) The conductors are first prepared as illustrated in figure 8-3. This preparation results in the splices of the two conductors being staggered to prevent excessive bulk and eliminate the possibility of electrical contact between them. The insulation is left on the ends of the conductors to bind the strands of wire together until after the square knots have been tied. Tie the square

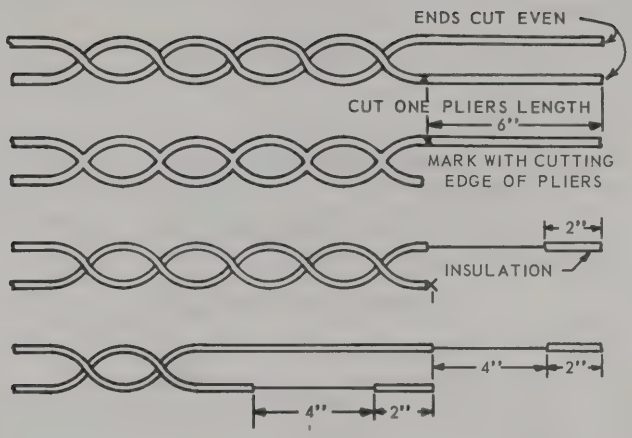


Figure 8-3. Preparation of wire for splicing.

knots as indicated in figure 8-4. After the first knot is tied, the twist is restored in the wire line by wrapping the 2 remaining untied conductors around the 2 conductors already tied. After the twist is restored, the second square knot is tied. Both knots should be tied one after the other so that communication is possible even though the splice has not been completed. After the knots have been tied, the insulation that was left on the ends of the conductors is removed.

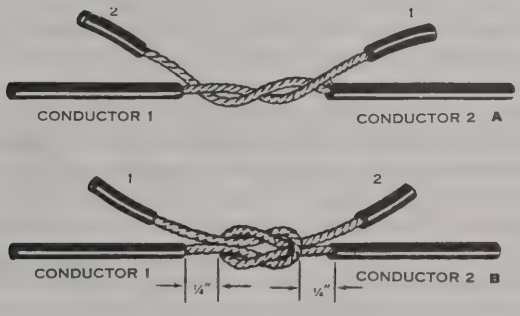


Figure 8-4. Tying the square knot.

(2) After the insulation has been removed from the ends of the conductors, the steel and copper strands should be separated as shown in figure 8-5. The steel strands are then cut even with the insulation on the side of the knot from which they protrude. The copper strands are bent across the square

knot to the side opposite that from which they protrude and wrapped until they extend 2 or 3 turns onto the insulation. The purpose of this is to seize the knot so that it cannot slip, and to bind the steel strands down against the conductors so that they cannot penetrate the tape and cause a ground or short circuit.

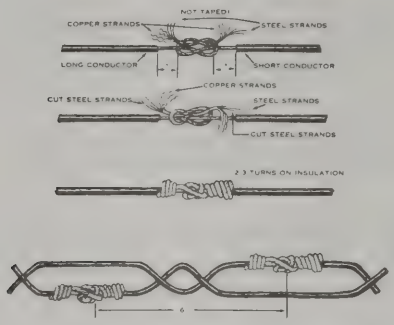


Figure 8-5. Construction of the splice.

(3) After the splices are seized, the next step is to tape the splice to prevent water seepage or short circuits. The taping procedure is indicated in figure 8-6. Electrical Insulation Tapes TL-636/U, (black polyethylene for tropical and temperate zones) or TL-600/U (white polyethylene for artic zones and cold weather) may be used. Remove the backing and stretch the electrical tape to activate its self-bonding properties. Start taping at the center of the splice. Use a steady pull and tape at least 1 inch beyond the insulation on one end. Tape again over the knot to at least 1 inch beyond the insulation on the other end. Reverse direction and tape back to the center of the splice. The final step uses Tape TL-83 (friction) for added protection. Start taping the splice at either end about 1/2 inch beyond the electrical tape, and tape to a point about 1/2 inch beyond the other end.

(4) If a wire line is accidentally broken, and the necessary equipment to properly construct a field wire splice is not available, the following steps may be taken to restore communications. Use a bayonet or some other sharp instrument to prepare the wire as close as possible to figure 8-3. Tie the first square knot, restore the twist, and tie the second square knot. If time is available, seize the knots with the copper strands. If tape is not available, raise the splices off the ground and separate them with a stick or twig so that there is no possibility of electrical contact between the conductors. When sufficient equipment is not available to construct a permanent splice, the splice should be marked so that it will be easy to locate. Communications personnel should be notified of its location as soon as possible.

d. Field Wire Ties. Field wire ties are used to hold wire lines in place at an abrupt change in direction, at all crossings, and to relieve the strain on wire lines at their terminating points. Field wire should always be tied securely to a convenient tree, equipment D-ring, or other support before connecting it to the equipment's binding posts. Field wire lines should also be tied at various points along the route. Basic field wire ties are explained and illustrated in FM 24-20, chapter 5.

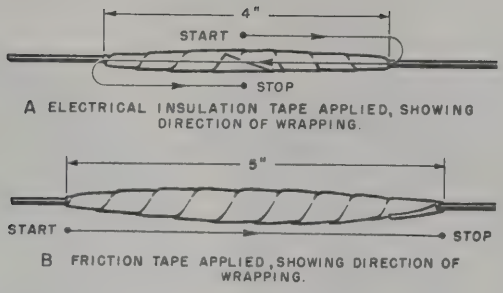


Figure 8-6. Taping the splice.

e. Field Wire Marking. Field wire lines are tagged to provide a method of identification, simplify the relieving of a unit place by another unit and aid maintenance personnel. The lines should be marked as they are laid and the tags attached at terminations, road and railroad crossing points, branches and intervals along the route. The unit CEOI will contain the wire tagging code. Information on field wire marking is contained in FM 24-20, paragraphs 78-79.

8-3. WIRE LAYING/RECOVERY EQUIPMENT

Field wire may be laid from reel units mounted in vehicles, reels or axles carried by hand, or dispensers mounted on aircraft or vehicles.

a. Field Wire Reels and Dispensers. Metal spool-type reels are used to store, transport, lay, and recover field wire. Special canvas dispensers may also be used to lay field wire lines.

(1) Reel, Cable DR-8. The DR-8 reel is a metal drum used to hold 1/4 mile (0.4 kilometers) of Field Wire WD-1/TT. It is used with the Reeling Machine RL-39.

(2) Reel, Cable RL-159/U (fig 8-8). The RL-159/U reel is a metal drum used to hold 1 mile (1.6 kilometers) of Field Wire WD-1/TT. It is used with the Axle, Cable, Reel RL-27 and the Reeling Machine RL-31.

(3) Wire Dispenser MX-306A/G (TM 11-2240) (fig 8-7). The Wire Dispenser MX-306A/G is an expandable, cylindrical-shaped, canvas holder fashioned around a previously wound coil containing approximately 1/2 mile (0.8 kilometers) of Field Wire WD-1/TT. This method of packaging permits wire to be payed out from the center of the dispenser at speeds varying from that of a man walking to a slow-flying (50-60 knots) aircraft. (Information on wire laying by aircraft is contained in FM 24-20, chapter 9, and FM 1-105, chapter 17.) D-rings are located at 90-degree intervals on the outside of the dispenser for lashing it to a packboard or vehicle. It is approximately 13-1/2 inches in diameter, 5 inches thick, and weighs 26 pounds when loaded. Two or more dispensers may be prespliced in tandem when it is necessary to lay a line longer than 1/2 mile without stopping. Continuous communications can be maintained while the wire is being laid.

b. Reel Equipment. Reel equipment is used in conjunction with wire reels to lay or recover wire. There are several types designed for 1- or 2-man and vehicular operation.

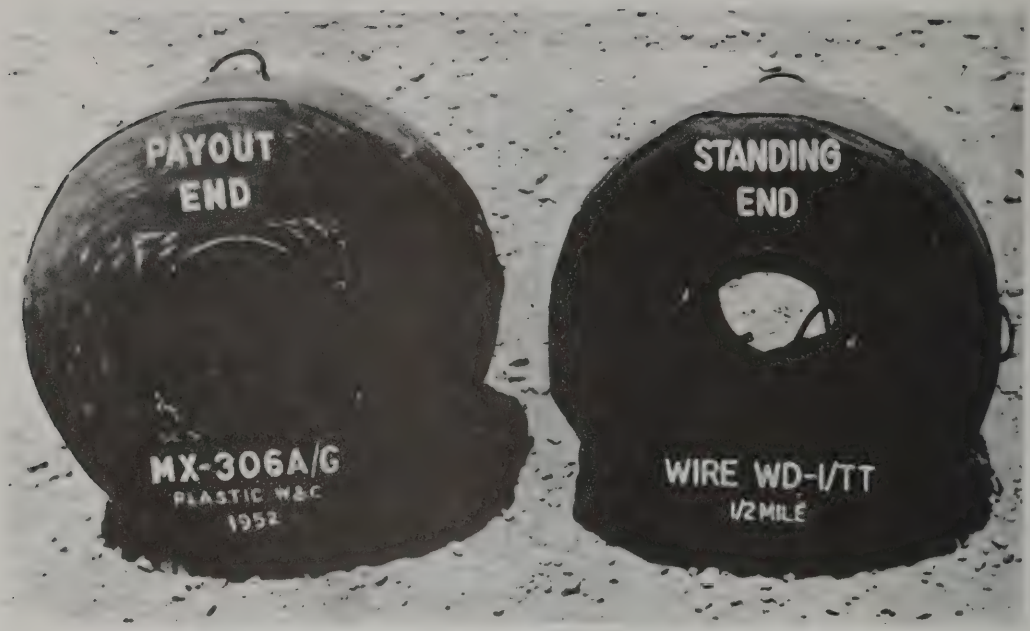


Figure 8-7. Wire Dispenser MX-306A/G.

(1) Axle, Cable, Reel RL-27(*) (TM 11-3895-201-13P) (fig 8-8). Axle RL-27 is an 8-pound, machine-steel bar, 2-1/2 feet long used for mounting wire reels. The axle has two knurled handles, one of which is removable for mounting the wire reel. It has roller bearings and is equipped with a removable crank for rewinding wire. The axle can be carried by two men or operated on an improvised mounting. It is issued on the basis of one per RL-159 reel.

(2) Reeling Machine, Cable, Hand RL-39 (fig 8-9). Reeling Machine RL-39 is a lightweight, chest type reel unit consisting of an axle with carrying handles, carrying straps and a crank for rewinding. The unit mounts DR-8 reel and is issued on the basis of one per reel. The DR-8 reel is not a component of the RL-39 reeling machine.

(3) Reel Equipment CE-11 (TM 11-3895-203-15) (fig 8-9). Reel Equipment CE-11 consists of an RL-39 reeling machine and a sound-powered Telephone Set TA-1/PT (para 8-5b), with its case and carrying strap. The operator of unit may establish communications with the distant end by connecting the sound-powered telephone to the terminals on the DR-8 reel. The DR-8 reel is not a component of Reel Equipment, CE-11.

(4) Reeling Machine, Cable, Hand RL-31 ( ) (TM 11-362) (fig 8-10). Reel Unit RL-31 is a lightweight portable, folding A-frame of steel tubing used for paying out and recovering field wire. It can be set up on the ground or mounted on a vehicle. A special vehicular installation kit is available for mounting the unit on a truck. It will accommodate two RL-159 reels. It has a brake unit to control the speed of the reel(s) during pay out of wire. A divided axle permits either reel to operate independently of the other. Two carrying straps are provided for carrying the reel unit litter style.

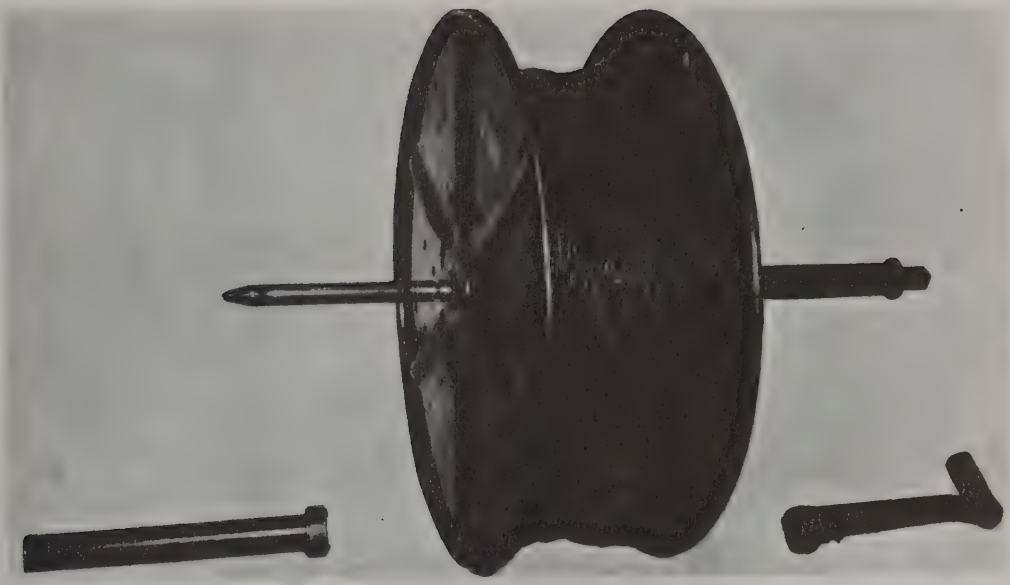


Figure 8-8. Axle, Cable, Reel RL-27, showing the removable handle and Reel, Cable, RL-159/U.

Figure 8-9. Recovering wire with Reel Equipment CE-11 (RL-39 reeling machine with a TA-1 telephone).

Figure 8-10. Reeling Machine, Cable, Hand RL-31.

(5) Reeling Machine, Cable, Motor Driven RL-172A/G (TM 11-3895-207-10) (fig 8-11). Reeling Machine RL-172 is authorized in the communications platoon of the HHC, armored brigade. It is normally employed, mounted vertically on the rear of a vehicle, with 24-volt dc power being supplied by the vehicle's electrical system. It weighs approximately 110 pounds and will accommodate one RL-159 reel. A hand crank is provided for manual operation. It is designed for one-man operation and has controls for starting, stopping, and reversing the direction of rotation of the reel.

c. Terminal Board TM-184 (fig 8-12). Terminal Board, TM-184 is a block of insulating material on which are mounted 28 binding posts. Seven pairs of wire lines can be terminated on the board. It serves as a convenient test point where a large number of lines are terminated, such as in the command post area. When installed in the open, the TM-184 terminal requires an improvised cover to protect it from the effects of the weather.

8-4. MANUAL TELEPHONE SWITCHBOARDS

Field telephone switchboards are manually operated devices designed for rapid, simple installation. They operate in 1 or more of 3 modes: Common battery (CB), local

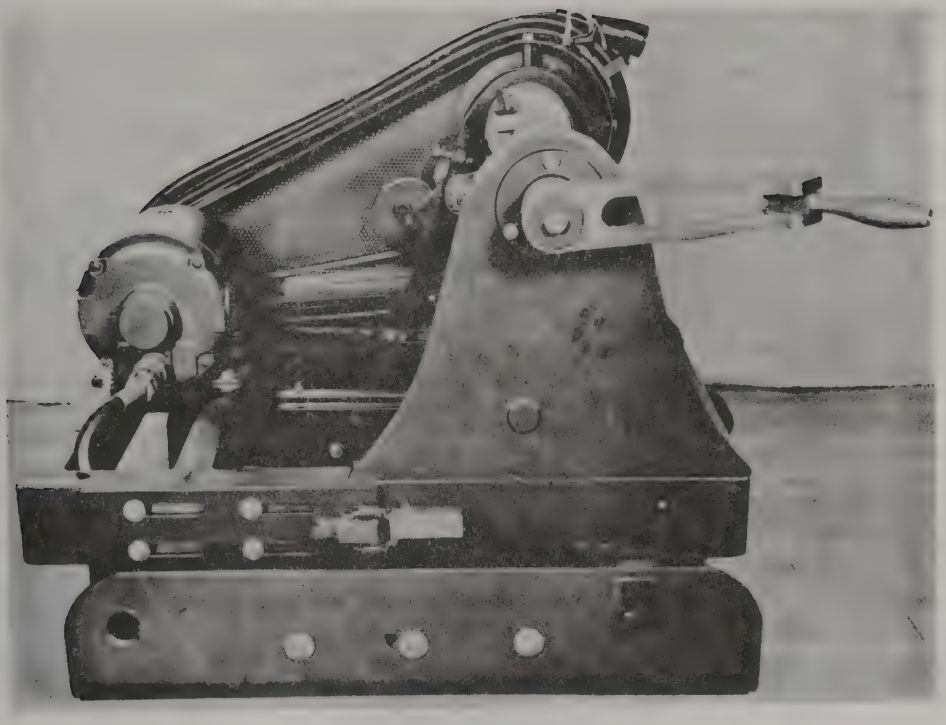


Figure 8-11. Reeling Machine, Cable, Motor Driven RL-172A/G.

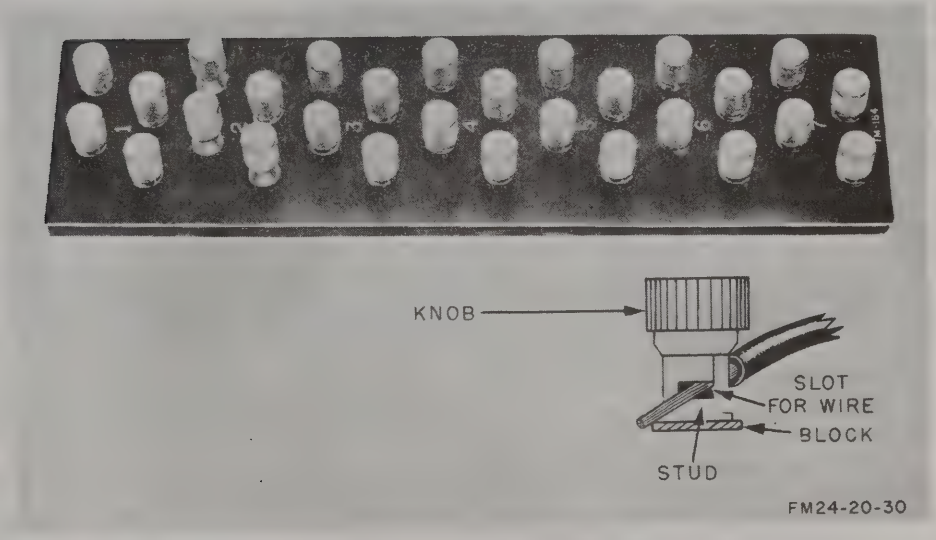


Figure 8-12. Terminal Board TM-184.

battery (LB), or common battery signaling (CBS). In a CB system the power source for speech and ringing signals is located at the switchboard. In an LB system the power source for speech and ringing signals is located at the telephone. In a CBS system the power source for speech is located at the telephone, and the power source for signaling is located at the switchboard. The field switchboards used in armor units include:

a. Switchboard, Telephone, Manual SB-993/GT (TM 11-5805-294-15) (fig 8-13). The SB-993/GT switchboard is a light, portable, LB switchboard normally used in company-size or smaller units. It consists of a plug holder and 7, 2-pronged adapter connectors in a case. Six subscribers and the operator's line can be terminated on the switchboard. Conference and line-to-line connections can be made. A field telephone is required for the operator's use. The SB-993 switchboard may be used as an emergency field replacement for any LB switchboard. Its weighs 2-1/4 pounds. A canvas case is provided to protect and carry the switchboard when it is not installed.

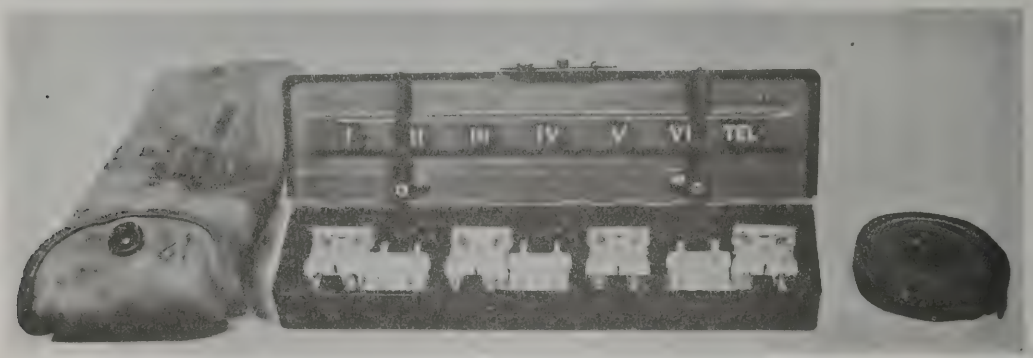


Figure 8-13. Switchboard, Telephone, Manual SB-993/GT.

b. Switchboard, Telephone, Manual SB-22A/PT (TM 11-5805-262-12) (fig 8-14). The SB-22A/PT switchboard is a single position, 12-line, LB-type switchboard. It can interconnect LB telephone circuits, voice-frequency teletypewriter circuits, and remote control circuits for radio-wire integration systems. The capacity can be increased by stacking 2 switchboards and replacing the operator's pack of 1 of them with 5 additional line packs Power is provided by four BA-30 batteries. In addition to a luminous drop in each line pack, the switchboard has facilities by which the operator may select either a light or a buzzer signal to alert him of an incoming call. The switchboard weighs 35 pounds. Its components are:

(1) Case and cover. The case houses the 12 line packs, operator's pack, battery case, and terminal strip in the rear for connecting incoming lines. The cover provides a storage compartment for the handset-headset.

(2) Operator's pack. The operator's pack contains the hand generator, operator's cord, and necessary switches for operation of the switchboard.

(3) Line packs. The line packs contain a luminous drop signal and a cord for interconnecting circuits.

(4) Accessory Kit MX-2915/PT. The accessory kit contains 2 spare lamps, 2 extra line packs, and 1 CBS trunk circuit pack that can be substituted for 1 of the line packs.

(5) Handset-Headset H-81A/U, H-144A/U, or H-144/U. The handset-headset is used by the operator and connects to the operator's pack.

c. Switchboard, Telephone, Manual SB-86/PT (TM 11-2134) (fig 8-15). Switchboard, Telephone, Manual SB-86/PT (fig 8-15), is a portable, 30-line, LB- or CBS-type switchboard. Capacity can be increased to 60 lines by stacking a second jack field section

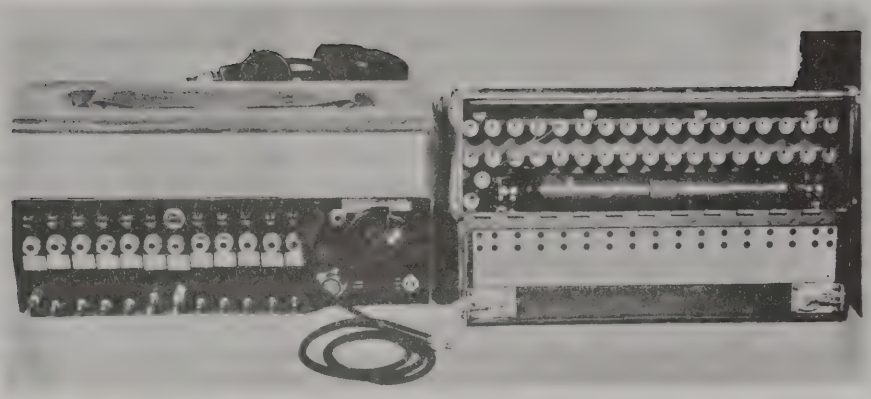


Figure 8-14. Switchboard, Telephone, Manual SB-22A/PT, front and rear view.

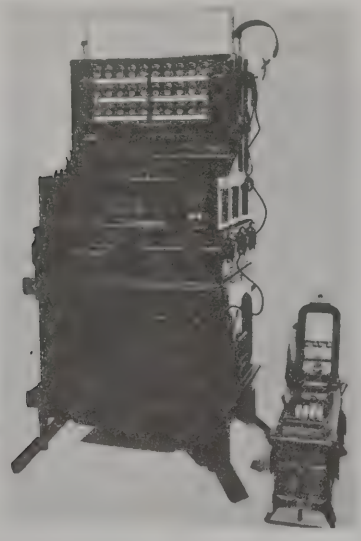


Figure 8-15. Switchboard, Telephone, Manual SB-86/PT.

above the first one. Two lines may be used for trunk connections to a CB switchboard. The switchboard weighs 180 pounds. Its components are:

(1) Outer cover assembly. The outer cover assembly is a metal case that serves as a storage and carrying case for the switchboard. The case serves as the base for the switchboard when it is operating.

(2) Switchboard assembly. The switchboard assembly is a metal case with eight cord packs and an operator's pack.

(3) Jack field section. The jack field section is a metal case containing 30 line circuits.

(4) Power supply. The power supply is a metal case with a meter and switches. It holds 10 BA-200/U batteries. In addition, 4 BA-30's are used, 2 for the night alarm and lamps and 2 for the operator's transmission power.

(5) Handset-Headset H-91/U. The handset-headset is used by the operator and connects to the operator's pack.

(6) Power cords. Two 6-foot (1 2-wire and 1 3-wire) power cords are used to connect the switchboard and the power supply.

(7) Canvas roll. A small canvas pack for spare parts (panel lamps, fuses, and lightning arrestor cartridges) is stored in the rear compartment of the jack field section.

d. Central Office, Telephone, Manual AN/TTC-29 (TM 11-5805-582-15) (fig 8-16). At armored brigade level, the SB-86 switchboard is employed in a vehicular- (3/4-ton cargo truck) mounted, air transportable shelter configuration, the AN/TTC-29. The basic component is one SB-86 switchboard with an extra jack field section providing a 60-line termination capacity. Connection capability is provided for 26 pair of cables and field wire. Two AN/TTC-29 central offices are assigned to the communications platoon of the HHC, armored division brigade. Power is provided by a generator PU-617/M, which is not a component of the central office. One AN/TTC-29 central office is employed to provide telephone service to the brigade command post and the other is installed in the trains area. The vehicular configuration permits rapid movement and quick installation.

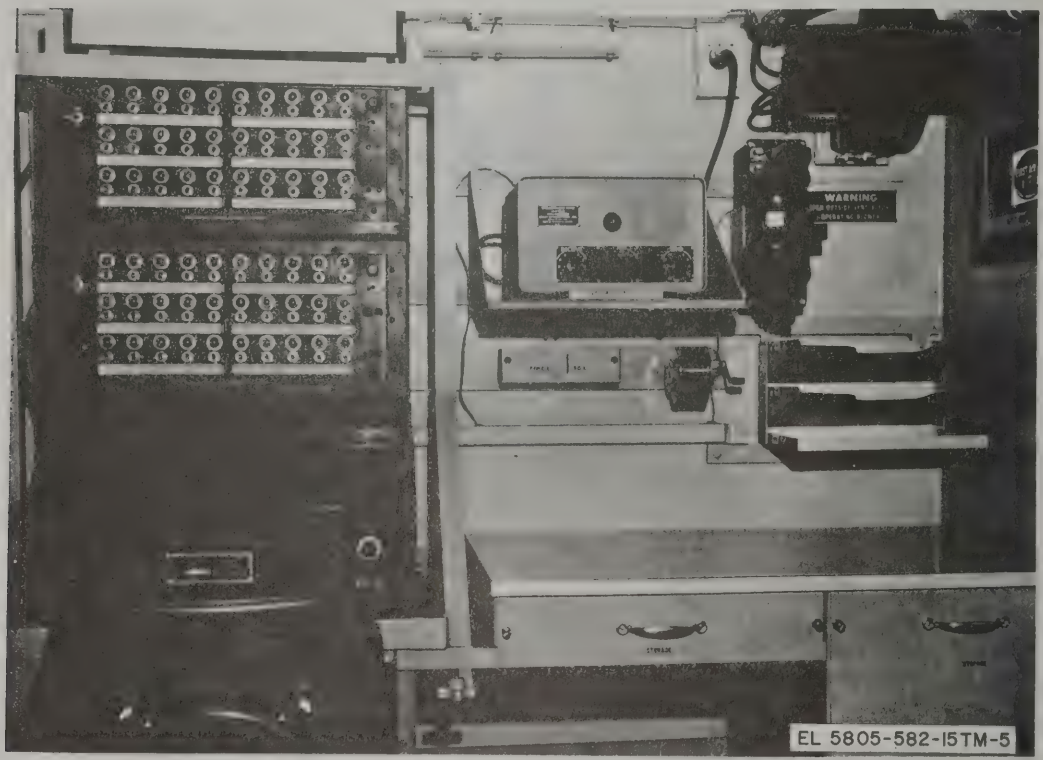


Figure 8-16. Central Office, Telephone, Manual AN/TTC-29, interior front view.

e. Grounding of Switchboards.

(1) Switchboards (with the exception of the SB-993) must be grounded to protect the equipment and operating personnel from lightning or other high voltages that may occur on the line. To ground a switchboard, drive a metal rod,

such as Ground Rod MX-148/G into the ground and connect it with Field Wire WD-1/TT (both conductors) or a ground strap to the ground terminals on the switchboard. Both the switchboard section and the jack field section of the SB-86 switchboard must be grounded. The AN/TTC-23 central office is equipped with a ground strap and ground rod, and the shelter is grounded at the power panel.

(2) The procedure for grounding is as follows:
   (a) Remove dirt or grease from the ground rod.
   (b) Scoop out a small hole about 6 inches deep.
   (c) Drive the ground rod into the hole until the top of the rod is approximately 3 inches above the bottom of the hole.
   (d) Connect the field wire or ground strap with good electrical contact to the ground rod and to the equipment.
   (e) Saturate the ground around the rod with water, fill the hole with earth, and add more water.
   (f) In dry soil it may be necessary to use more than one ground rod or add water occasionally to maintain good electrical contact between the ground rod and the soil.

8-5. FIELD TELEPHONES

a. Types.

(1) Field telephone sets are portable, self-contained equipment of durable construction, designed for field use. There are two types: sound powered and battery powered. They may be used over point-to-point or switched circuits.

(2) In a sound-powered telephone, the transmitter element is a generator of electrical energy. The sound waves created by the voice of the speaker strike the transmitter element and are converted directly into electrical energy. Sound-powered telephones have a shorter transmission range than battery-powered telephones.

(3) In a battery-powered telephone, dry cell batteries contained inside the set provide the source of transmission power.

(4) Both type field telephones use a hand-ringing generator for signaling. Incoming signals are indicated by a buzzer or a visual indicator.

b. Telephone Set TA-1/PT (TM 11-5805-243-12) (fig 8-17).

(1) Telephone Set TA-1/PT is a complete sound-powered telephone in handset form. Its transmission and signaling range is approximately 6 to 10 miles (9.6 to 16 kilometers) over Field Wire WD-1/TT. The Telephone Set TA-1 is designed for operation on point-to-point circuits and for use with local battery switchboards. It weighs approximately 3-1/2 pounds with the carrying case.

(2) Telephone Set TA-1 provides an audible and a visible signal. The audible signal can be adjusted in volume from LOUD to OFF. The visible signal operates whenever the telephone is signaled regardless of the position of the volume control lever.

c. Telephone Set TA-312/PT (TM 11-5805-201-12) (fig 8-18). Telephone Set TA-312/PT is a battery operated (two BA-30 batteries) set, designed primarily for operation on LB switchboards, but may also be used in CB and CBS installations. Its operating range over Field Wire WD-1/TT is from 14 to 24 miles (22.4 to 38.4 kilometers). It may be operated with an external Handset-Headset H-144/U (TM 11-5965-206-15P), which is not a component of the telephone set. Operation with the handset-headset is desirable in areas where personnel must have both hands free to operate the equipment. The Telephone Set TA-312 has a hand crank generator for signaling. The signaling buzzer can be adjusted from LOUD to LOW but it cannot be turned completely off.

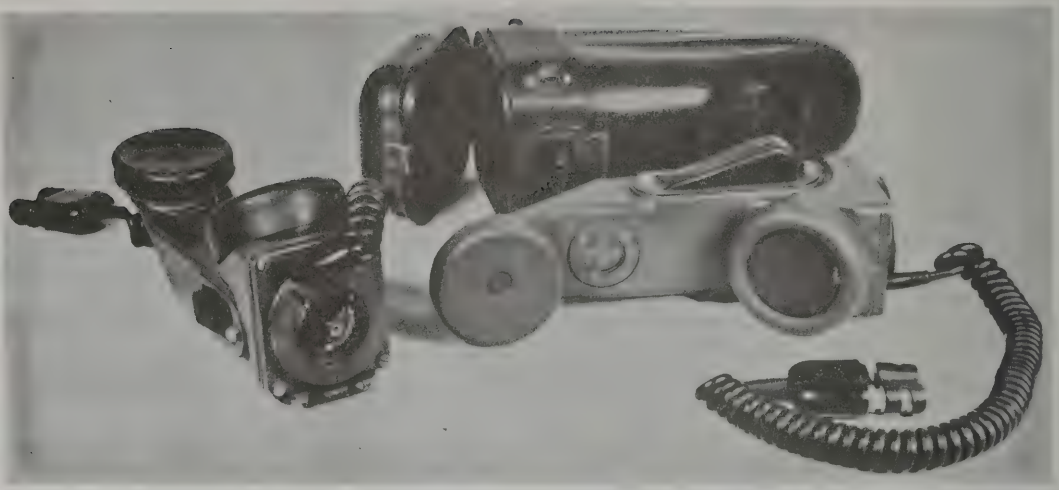


Figure 8-17. Telephone Set TA-1/PT, front and end view.

Figure 8-18. Telephone Set TA-312/PT.

d. Emergency Operation. Emergency operation is possible with both types of field telephones with reduced operating range.

(1) If either the transmitter or receiver elements of the Telephone Set TA-1 become ineffective, it is still possible to transmit and receive. Either element can be used for both purposes.

(a) If the transmitter is inoperative, speak directly into the receiver. Do not press the push-to-talk switch. Listen at the receiver in the normal manner.

(b) If the receiver is inoperative, speak into the transmitter in the normal manner. Listen at the transmitter and keep the press-to-talk switch depressed while listening as well as when transmitting.

(2) If the transmitter element of the Telephone Set TA-312 is defective or if no batteries are available, it is possible to transmit and receive using the receiver. Speak directly into the receiver to transmit and listen at the receiver in the normal manner.

8-6. TELETYPEWRITER EQUIPMENT

Teletypewriter equipment provides a rapid means for transmitting written messages over wire or multichannel radio circuits or a combination of both. The principal advantages of teletypewriter communications are the permanent copy (page or tape form) and the ease of retransmission using perforated tape. The disadvantages include equipment complexity, requirement for skilled operators, and mechanics and the necessity for high quality circuits.

a. Teletypewriter Set AN/PGC-1 (TM 11-5815-206-12) (fig 8-19). Teletypewriter Set AN/PGC-1 is a page printing, sending and receiving set. Its principal component is Teletypewriter TT-4(*)/TG. Normal operating speed is 60 words per minute, but extra gears are included for 100-word-per-minute operation. The teletypewriter set can be installed on top of the carrying case when a table or other operating space is unavailable. The set weighs 100 pounds.

Figure 8-19. Teletypewriter Set AN/PGC-1 (Teletypewriter TT-4).

b. Teletypewriter Set AN/GGC-3 (TM 11-5815-238-12) (fig 8-20). The Teletypewriter Set AN/GGC-3 is a keyboard or tape transmitting and a tape receiving set. Its principal component is Teletypewriter-Reperforator-Transmitter TT-76(*)/GGC. Normal operating speed is 60 words per minute, but extra gears are included for 100-word-per-minute operation. The TT-76 teletypewriter is installed on a teletypewriter table, which is a component of the set. It weighs 97 pounds.

Figure 8-20. Teletypewriter Set AN/GGC-3. (Teletypewriter-Reperforation-Transmitter, TT-76/GGC.)

c. Terminal Telegraph-Telephone AN/TCC-29 (TM 11-5805-356-12) (**fig** 8-21). Terminal Telegraph-Telephone, AN/TCC-29 is a set of three self-contained components. It provides the capability for simultaneous transmission of teletype and voice signals in the voice frequency range. One or all of the components may be used depending on the type of employment.

(1) Terminal Telegraph TH-22/TG. This component converts direct current teletype signals on the local loop into voice frequency signals for line transmission. It also provides the capability for transmitting and receiving a break-in alarm. The TH-22/TG terminal must be used with the TT-4/TG and TT-76/GGC teletypewriters when they are interconnected over voice frequency circuits.

(2) Converter, Telegraph-Telephone Signal CV-425/U. The CV-425/U converter shifts 20-hertz ringing signals to higher frequency teletype and telephone signals for transmission over voice frequency circuits and performs the opposite conversion for transmission over the local loop.

(3) Filter Assembly F-316/U. The F-316/U is a 2-section filter. The band-pass section is used for teletype signal transmission. The band-stop section is used for telephone signal transmission.

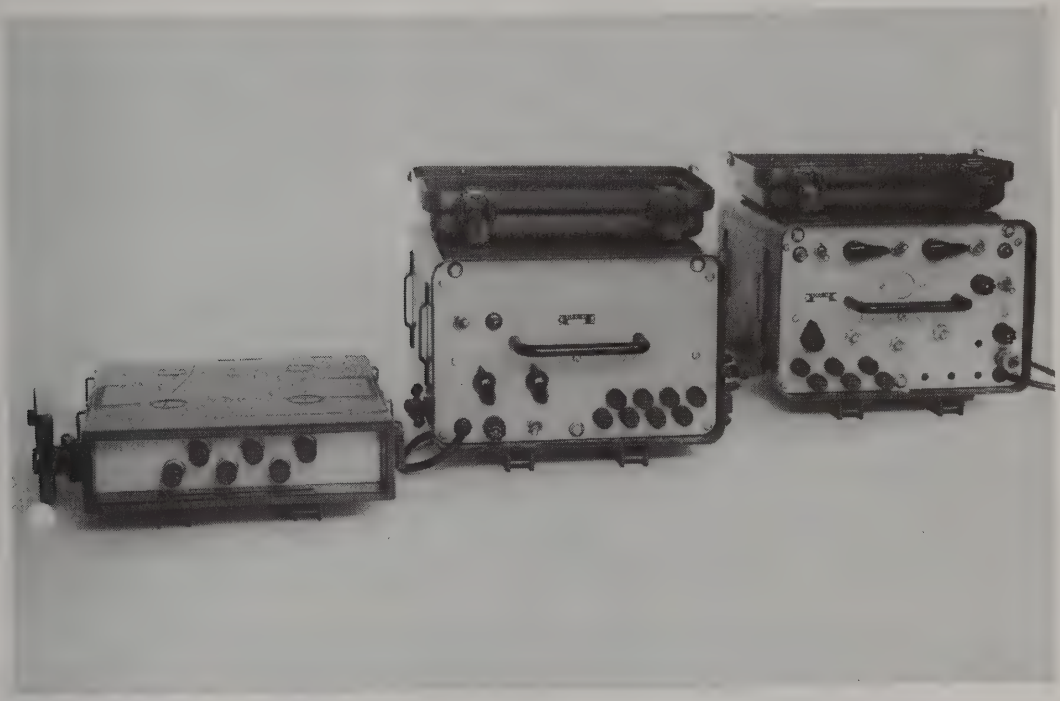


Figure 8-21. Telegraph-Telephone AN/TCC-29.

CHAPTER 9

VISUAL, SOUND, AND MESSENGER COMMUNICATIONS

9-1. GENERAL

The armor commander must avoid reliance on a single means of communication. Since all means are subject to interference, accidents, enemy action, and personnel and equipment failure, the reliability of a unit's communications system is strengthened by the use of multiple means of communications. Armor units employ radio as the primary means of communication, but visual, sound, and messenger must be used as supplemental means in many cases. Allocation of equipment and personnel to operate such supplemental means will be determined by the use and importance of each of them in a particular situation.

9-2. VISUAL COMMUNICATIONS

Visual communications are widely used within armor units. They are suitable for transmitting prearranged messages rapidly over short distances, as well as for recognition and identification of friendly forces. Visual communications are easily misunderstood, are vulnerable to interception, and the enemy may use similar communications for purposes of confusion and deception. Their use is restricted during conditions of poor visibility or when line-of-site positions are not available. In some situations, their use may be prohibited for security reasons. However, they are particularly useful during periods of radio and listening silence.

a. Arm and Hand Signals. Standard and special arm and hand signals are used by armor personnel to control small unit actions, recovery operations, and vehicle and aircraft movement. These signals are illustrated in FM 21-60, sections II and III. Arm and hand convoy control signals with and without a flashlight are illustrated in TM 21-305, chapter 23, and TM 21-306, chapter 2.

b. Flags. Messages may be sent with flags by using prearranged signals, the semaphore alphabet, or wigwag representation of International Morse Code characters. Flag set M238, is a basic issue item for the M60A1 tank and the M551 armored reconnaissance vehicle. It consists of three flags (red, green, and orange) and a canvas carrying case. Messages may be transmitted by using a single flag or a combination of 2 or 3 flags according to a prearranged code. In armor units signal flags are generally used for range fire control and battle drill training. Standard flag signals are contained in FM 21-60, section V, and TM 21-306, chapter 2.

c. Lights.

(1) Flashlights, xenon searchlights, or other type lights may be used to transmit brief prearranged messages, such as the identity of friendly units, based on the meanings given in the unit CEOI or as prescribed by the commander. International Morse Code messages may be transmitted with lights. Infrared lights are particularly useful to increase communications security during darkness and when weather conditions prevent the use of other visual means.

(2) The basic issue item list for armor combat vehicles includes from 1 to 3 flashlights (with the exception of the M114 armored command and reconnaissance carrier which is not authorized a flashlight). Each M60A1 tank and M551 armored reconnaissance vehicle is authorized a xenon searchlight by TOE.

(3) Flashlight arm and hand signals for controlling vehicle movement are contained in FM 21-60, section II. FM 21-60 also contains aircraft traffic control light signals and aircraft landing area lighting requirements in section VII.

d. Pyrotechnics.

(1) Pyrotechnics are ammunitions containing chemicals that produce a smoke or brilliant light while burning. They are used for signaling or for lighting up an area at night and are available in various types and colors. The pyrotechnic

signal meanings are included in the unit CEOI. They are generally used for friendly unit identification, fire support control, target marking, and location reports. Pyrotechnics may be used for ground and ground-to-air communications. Their principal advantage is the speed with which specific information can be transmitted to large numbers of troops and to isolated units.

(2) The meanings for pyrotechnic signals should be brief and simple. Combinations of colors fired simultaneously or in sequence increase the possibility of error since an observer may miss part of the sequence or be unable to distinguish the various colors. Messages transmitted by means of pyrotechnics should be confirmed by another means of communications at the first opportunity, since the originator has no assurance that the pyrotechnic signal was observed and understood by the intended receiver.

(3) Pyrotechnic signals can easily be imitated by the enemy, so complete reliance cannot be placed on them unless the originating source can be positively identified. They can also be readily observed by the enemy. Therefore, the need for security must be considered in order not to disclose the location or intention of a friendly unit.

(4) General information concerning the employment of pyrotechnics is contained in FM 21-60, section VI. More detailed technical and operational information is contained in FM 23-30 and TM 9-1370-200.

e. Panels. Two general types of panels are used by armor units for communicating with aircraft. Employment and code information is contained in FM 21-60, section VII, and in ACP 136(B).

(1) Marking and identifying panels.

(a) Marking and identifying panels are made in bright fluorescent colors. They are used to mark landing areas, drop zones, unit positions, and to identify units as friendly. Identification displays are prescribed in the unit CEOI.

(b) Panel Marker, Aerial Liaison Type VS 17/GVX is issued on the basis of 2 per combat vehicle and 2 per 8 fuel consuming motor vehicles (or fraction thereof). It is a single panel 6 feet long and 2 feet wide. One side is yellow and the other is red.

(2) Message panels.

(a) Message panels are made in black and white sets for use on light and dark backgrounds, respectively. They are used to transmit brief messages or to identify a particular unit. The combined panel system and panel recognition code is contained in the unit CEOI.

(b) Panel Sets AP-30C and AP-30D. Each set consists of 13 panels (AP-30C white, AP-30D black). The panels are made of cotton cloth, each 12 feet long by 2-1/3 feet wide. They are provided with pins for fastening to the ground. These sets are authorized by TOE to the headquarters elements of the HHC and combat support company of the tank battalion and the armored cavalry troop and HHT of the armored cavalry squadron.

9-3. SOUND COMMUNICATIONS

a. Sound communications are typified by such simple devices as whistles, bugles, horns, sirens, gongs, bells, klaxons, voice amplifiers, and explosive devices. The principal uses of sound communications are to attract attention, transmit prearranged messages, and to spread alarms. Sound signals are satisfactory only for short distances and their range and reliability are greatly reduced by battle noise. Since they are vulnerable to enemy interception, their use may be restricted for security reasons. Sound signals must be kept simple to avoid misunderstandings.

b. The prearranged meanings for sound signals are contained in the unit SOP and CEOI. FM 21-60, appendix B, contains the standard sound warning signals for NBC hazard, air attack, ground attack, and all clear.

c. No equipment is provided in armor organizations to provide a means of sound communications. Public Address Sets AN/PIQ-5 and AN/TIQ-2 are found at division level (military police company, engineer bridge company, and band) but they are authorized to perform other functions. However, many expedients are readily available.

9-4. MESSENGER COMMUNICATIONS

a. Messenger communication is the most secure means available to armor units. It is the most effective method for transmitting lengthy messages and bulky items. The efficiency of the messenger communication depends on the selection and training of the messengers. Messenger communication is flexible and reliable but its speed depends on the mode of travel, tactical situation, terrain, and trafficability of routes. The limitations of messenger communication include vulnerability to enemy action in forward areas and lack of person-to-person contact.

b. Messengers are described by their mode of transportation (foot, motor, or air) and type of service (scheduled, special). Scheduled messengers are used when unit locations change infrequently and the quantity of traffic warrants a routing schedule. Messenger schedules may be included in the unit SOP, CEOI, or in the C-E annex of the operation order. Special messengers are used whenever more rapid service, special handling, or a high degree of security are required. The use of messengers may help relieve the traffic congestion over the other communications means. They also provide a means of transmitting classified material when a cryptographic capability is not available.

c. There is no specific messenger MOS. TOE messenger positions in armor units carry MOS's 36K, Field Wireman, or 72B, Communications Center Specialist. They are found in the communications elements of the tank battalion, armored cavalry squadron, and armored brigade. The division signal battalion provides motor messenger service between the armored brigade and the division command echelons through the forward area signal centers established in each brigade trains area.

d. Whenever necessary, dismounted troops can be designated and used locally as messengers. Air messenger service may be used when aircraft are available. Information on the use of field messages and messengers is contained in FM 21-75, chapter 5.

CHAPTER 10

GROUND SURVEILLANCE RADAR

10-1. GENERAL

The purpose of a ground surveillance radar set is to determine the location of one or more targets with respect to the position of the radar set. To accomplish this the radar set makes measurements of range, azimuth, and elevation. The range, or distance between the radar set and the target, is determined by the time elapsed between the transmission of a pulse of electromagnetic energy and the reception of its echo. The range can be determined because the pulse travels at a constant speed, the speed of light. Since the antennas used with ground surveillance radars are narrow beam and highly directional, the azimuth and elevation measurements can be determined from the orientation of the antenna. The ground surveillance radar set is designed primarily to detect moving targets. In order to do this it must receive echoes from a moving target as well as from stationary objects near the target (ground clutter). With most other type radar sets, it is desirable to eliminate such ground clutter. The moving target echo returns to the radar set with a slightly different frequency. This frequency difference permits detection of the moving target.

10-2. RADAR SET AN/PPS-5A (TM 11-5840-298-12) (Fig 10-1)

The Radar Set AN/PPS-5A is a portable, battery-powered radar set that is used for battlefield surveillance to locate and identify moving targets at ranges up to 10 kilometers. It can be remotely controlled from a distance of 50 feet (15.2 meters).

a. Pulse Frequency. The set transmits 4,000 pulses a second at a frequency of 16.0-16.5 GHz.

b. Range. The maximum ranges are 10 kilometers for vehicles and 6 kilometers for personnel, with an accuracy of ± 20 meters. Minimum range is 50 meters. The range is shown on the visual scopes of the remote control indicator and on a counter-type indicator on the radar set. A range gate isolates echoes from a selected part of the scanned area to more accurately determine target location.

c. Azimuth. The AN/PPS-5A radar set can traverse a full 6,400 mils when searchlighting at speeds ranging from 41 to 328 mils per second. It can scan a sector of 533, 1,067, 1,600 or 1,955 mils at the same speeds. Accuracy is ± 10 mils. Azimuth measurement is shown on a counter-type mechanism in the antenna drive unit and on both a slave counter and the area scope of the remote control indicator.

d. Elevation. The elevation can be set from -600 to +400 mils by means of a manual handwheel on the radar set. The elevation reading is shown on a counter-type indicator. Accuracy is ± 10 mils.

e. Beam Width. Horizontal width is 20 mils and vertical width is 62 mils.

f. Target Presentation. Targets are presented in four ways: bright spots on an area scope, wave shapes on a linear scope, audio signals in a headphone, and meter deflections. Audio signals are used to assist the operator in locating a moving target more accurately by adjusting for maximum signal strength and for identifying the target by the type of audio tones received. Target echoes also cause a test meter deflection that can be used to assist in azimuth and elevation measurements.

g. Power Source. The set will operate directly off a 6-volt storage battery (BB-662/U) in a battery case that can be mounted on back of the receiver-transmitter. This is the power source used when silent operation is required. Operation from an external 24-volt dc source is possible through Power Supply PP-4450A/PPS-5. This type operation eliminates the need for charging or replacing storage batteries.

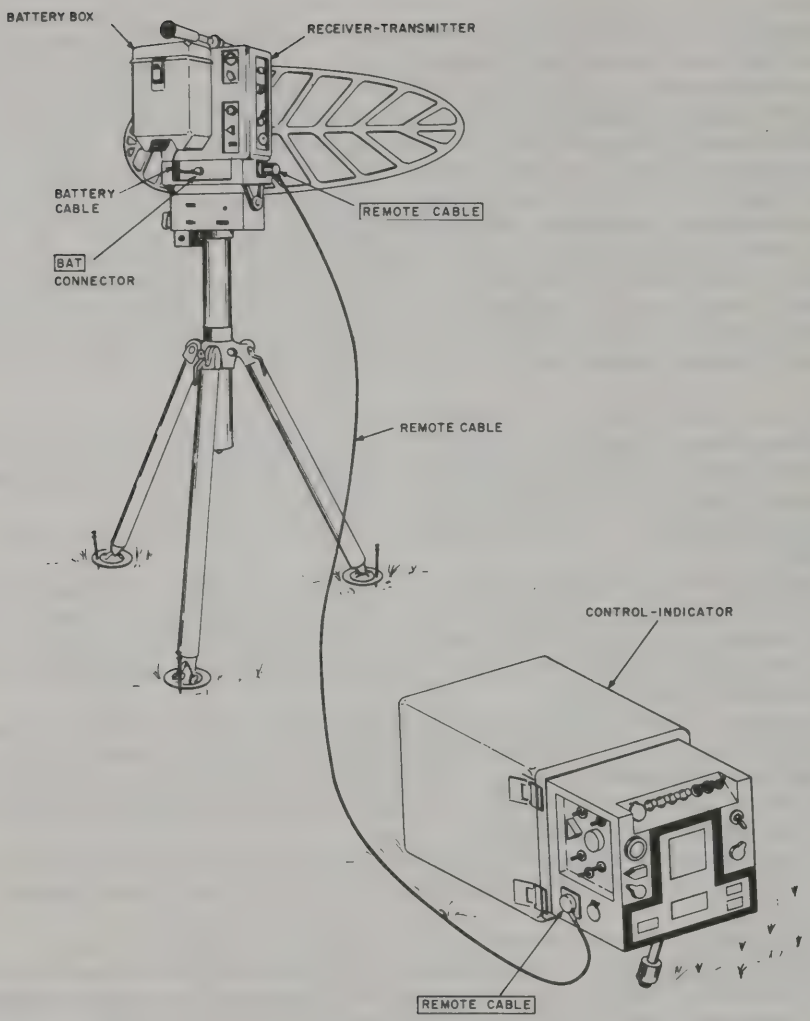


Figure 10-1. Radar Set AN/PPS-5A.

CHAPTER 11

RADIAC EQUIPMENT

11-1. GENERAL

Nuclear weapons produce casualities by three effects: blast, thermal radiation (heat and light), and nuclear radiation. Gamma rays and beta and alpha particles are emitted by the fallout materials from a nuclear explosion and also result from the induced radioactivity in the vicinity around ground zero. The presence of nuclear radiation cannot be determined by the human senses. Therefore, radiac instruments are necessary to detect and measure it. Of the three types of radiation, gamma rays are the most dangerous.

a. Alpha Particles. Alpha particles are atoms of helium that contain a positive charge as a result of having lost two electrons. They are ejected from a radioactive atom at a velocity about one-twentieth of the speed of light. Their range in air is only a few inches. They can be absorbed by a few sheets of paper. Therefore, alpha particles, outside the body, are not militarily dangerous.

b. Beta Particles. The beta particle is an electron. Like the alpha particle, it is emitted from a radioactive nucleus. Although its velocity approaches the speed of light, its range in air is only a few feet. The only danger occurs when material emitting beta particles remains in contact with the skin. Sores and burns may result. Beta particles can be absorbed by a 1/4-inch thick sheet of lucite.

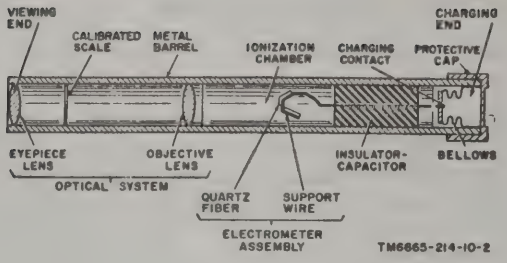
c. Gamma Rays. Gamma rays are not particles but electromagnetic rays similar to Xrays. They travel with the speed of light and have a very high penetration capability. Gamma rays are developed when a radioactive atom contains an excess amount of energy following the ejection of an alpha or beta particle. Gamma rays are the most dangerous form of radiation since they cause damage to human tissue and blood forming cells.

d. Radiation Detection. As alpha and beta particles travel through the air, they have collisions with atoms which result in knocking electrons off the neutral atoms and the production of ions (charged particles). Gamma rays produce ions by a secondary effect. Their absorption by neutral atoms results in the emission of electrons which produce further ionization. It is through this ionization effect that we are able to measure radiation. Radiac instruments measure the amount of ionization created inside a special chamber. This provides a measure of the existing radiation level. All armor units have TOE authorization for radiac equipment for both monitoring and survey purposes. A specific TOE capability of the armored cavalry squadron is, "conducts radiological monitoring and survey." Monitor and survey teams are assigned for each authorized survey meter. FM 3-12 provides information on the operational employment of radiac equipment and FM 1-105, chapter 14, contains information on the employment of radiac meters for aerial radiological survey.

e. Unit of Measure. For military purposes the unit of absorbed dose of ionizing radiation is the rad. The dose rate is commonly measured in rads per hour. A common scientific unit of radiation dosage is the roentgen. The two units are identical and the scales of older model radiac equipment, marked in roentgens, can be read directly in rads.

11-2. RADIAC METER IM-93A/UD, (TM 11-6665-214-10) (Fig 11-1)

The Radiac Meter IM-93A/UD is the standard Army dosimeter. It detects and measures cumulative exposure to gamma radiation. It can be carried in the user's pocket or placed in an area where total radiation exposure is to be measured. The IM-93 dosimeter is an air-tight, ionization chamber sealed in a small metal barrel with a pocket clip on one end. A magnifying lens system permits reading of a scale ranging from 0 to 600 rads. Charging (para 11-3) is necessary prior to using the IM-93 dosimeter. It should be stored in a charged condition and be recharged monthly.



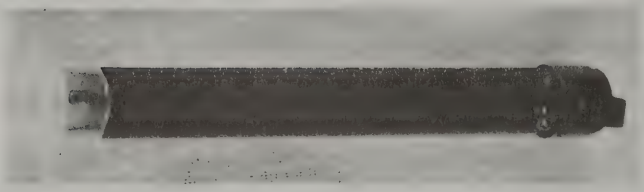


Figure 11-1. Radiac Meter IM-93A/UD.

11-3. CHARGER, RADIAC DETECTOR PP-1578A/PD (TB Sig 226-8) (Fig 11-2)

The PP-1578 charger is an electrostatic frictional generator. It is used to charge various types of dosimeters, including the IM-93. The dosimeter is placed on the charging pedestal and the scale set to zero by rotating the charging knob. The PP-1578 charger is equipped with a canvas carrying case.

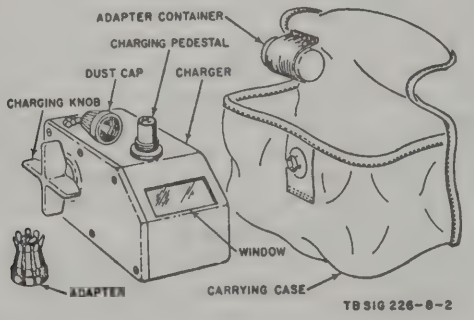


Figure 11-2. Charger, Radiac Detector PP-1578/PD.

11-4. RADIAC METER IM-174A/PD (TM 11-6665-232-12) (Fig 11-3)

Radiac Meter IM-174 is a survey meter designed to measure gamma radiation dose rates from 1 to 500 rads per hour. It requires 3 types of batteries (2 each BA-1006/U, BA-1391/U, and BA-1396/U) for operation. The IM-174 radiac meter is equipped with a nylon carrying case with a canvas strap.

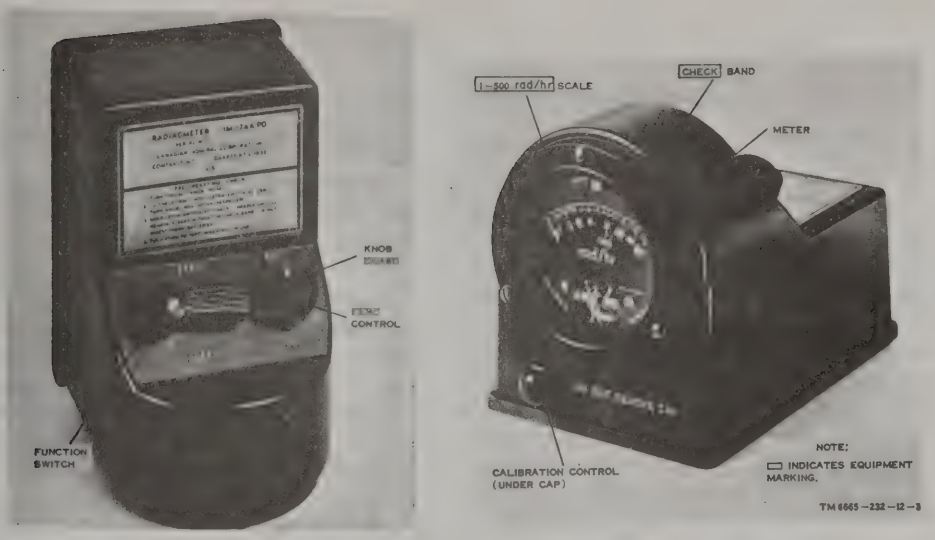


Figure 11-3. Radiac Meter IM-174A/PD.

11-5. RADIAC SET AN/PDR-27 (*) (R MODEL, TM 11-6665-230-15; P MODEL, TM 11-6665-209-15; J, L, AND Q MODELS, TM 11-6665-209-15) (Fig 11-4)

The AN/PDR-27 radiac set is a gamma and beta radiation detection and measuring instrument usable for either radiological monitoring (personnel, food, or water) or survey (in areas of low radiation intensity). It has a 4-scale meter with a maximum possible reading of 500 millirads. A thin shield on the detector probe can be moved aside when it is desired to measure gamma plus beta radiation. A headset can be used to provide an aural indication of radiation intensity. Operating power is provided by six BA-30 batteries. There are several models of the AN/PDR-27 radiac set, but primary differences are in the internal wiring. The set is equipped with a carrying harness and a radioactive test sample that permits the operator to check the condition of the radiac set. The set weighs about 10 pounds with batteries.

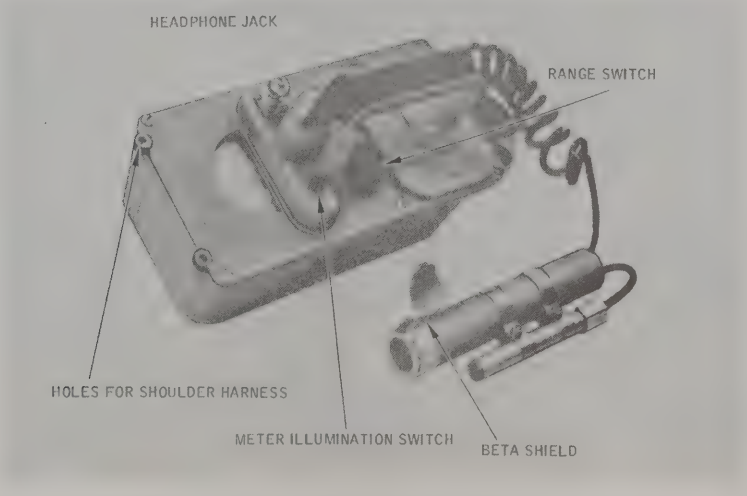


Figure 11-4. Radiac Set AN/PDR-27.

CHAPTER 12

COMMUNICATIONS SECURITY EQUIPMENT

12-1. SPEECH SECURITY EQUIPMENT

The TSEC/KY-8, TSEC/KY-28, and TSEC/KY-38 are compatible, tactical, push-to-talk, speech security devices designed to provide secure FM voice communications. Used within armor units from company level to division, these devices greatly enhance the security and responsiveness of armor units in tactical operations. This equipment is unclassified for external viewing, but is classified a minimum of CONFIDENTIAL for internal viewing. If a higher classification key list is used, then the equipment interior assumes the same classification as the key list. Protection appropriate to the degree of classification must be provided in accordance with the minimum standards established in (C) AR 380-40, paragraph 4-7, Operator's manual, (C) KAO-153A, provides detailed keying and operating instructions for all three devices. These two references should be maintained by the unit COMSEC custodian.

a. The TSEC/KY-8 (fig 12-1) (TM 11-5810-224-10) was designed to be mounted in a vehicle (wheel, track, vessel, or aircraft) and to operate from the vehicle power supply. It weighs approximately 34 pounds, and is used with the AN/VRC-12 series radios and with minor modification can be used with various aircraft FM equipment.

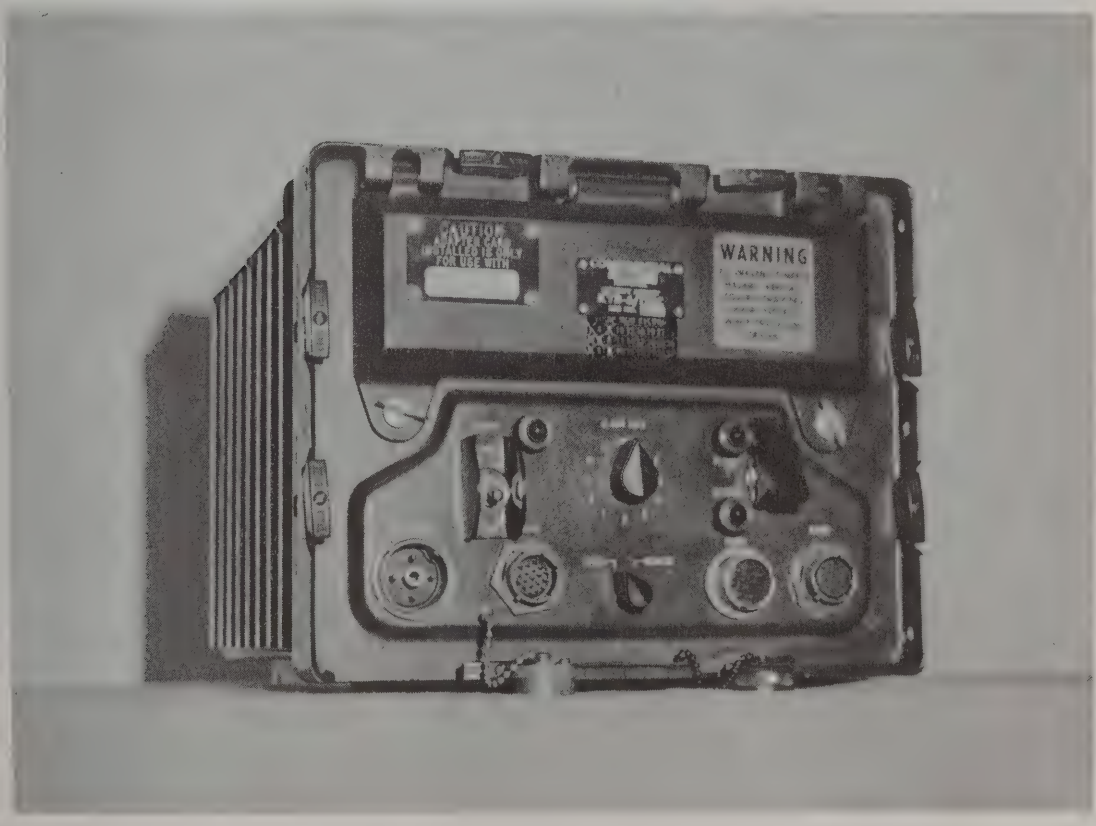


Figure 12-1. Speech Security Device, TSEC/KY-8.

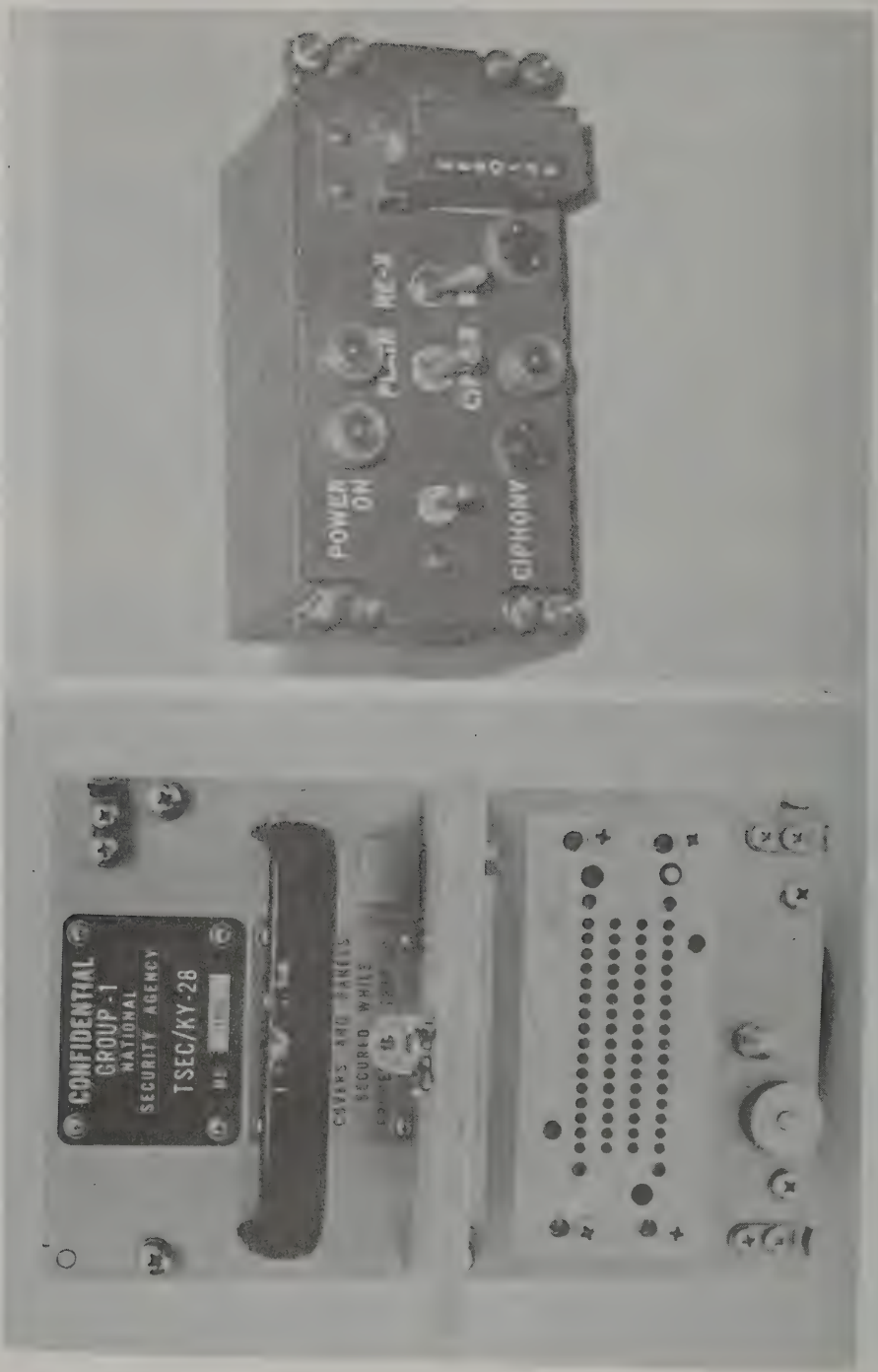


Figure 12-2. Speech Security Device, TSEC/KY-28 with Control Indicator C-8157/ARC.

b. The TSEC/KY-28 (fig 12-2) (TM 11-5810-244-10) is smaller than the TSEC/KY-8. It is designed for use in US Army aircraft, but may be used in ground applications in a manner similar to the TSEC/KY-8. It is used with Radio Sets AN/ARC-131, AN/ARC-114, AN/ARC-54, and AN/ARC-51BX.

c. The TSEC/KY-38 (fig 12-3) (TM 11-5810-245-10) is the portable or man pack version used with the AN/PRC-77 series radios. It weighs approximately 24-1/2 pounds with two AN/PRC-77 batteries as a power supply. With proper installation kit, it can be mounted in a vehicle for use with the AN/VRC-12 or AN/PRC-77 series radios. The battery compartment is replaced with a power unit (Z-ACD) that regulates the vehicle power for use by the security equipment.

d. The HYL-3/TSEC digital regenerative repeater (TM 11-5810-247-10) is required at a retransmission station to enable it to pass secure speech transmissions. It can be used with either the AN/VRC-12 or AN/PRC-77 series of radios.

12-2. TELETYPE SECURITY EQUIPMENT

The TSEC/KW-7 (fig 12-4) (TM 11-5810-209-12P) is used to secure teletype communications within armored units including both landline and radioteletype. It is an on-line, synchronous, half-duplex security equipment requiring 21-31 volts dc or 115/230 volts ac for operation. The teletype operator is trained in TSEC/KW-7 operation.

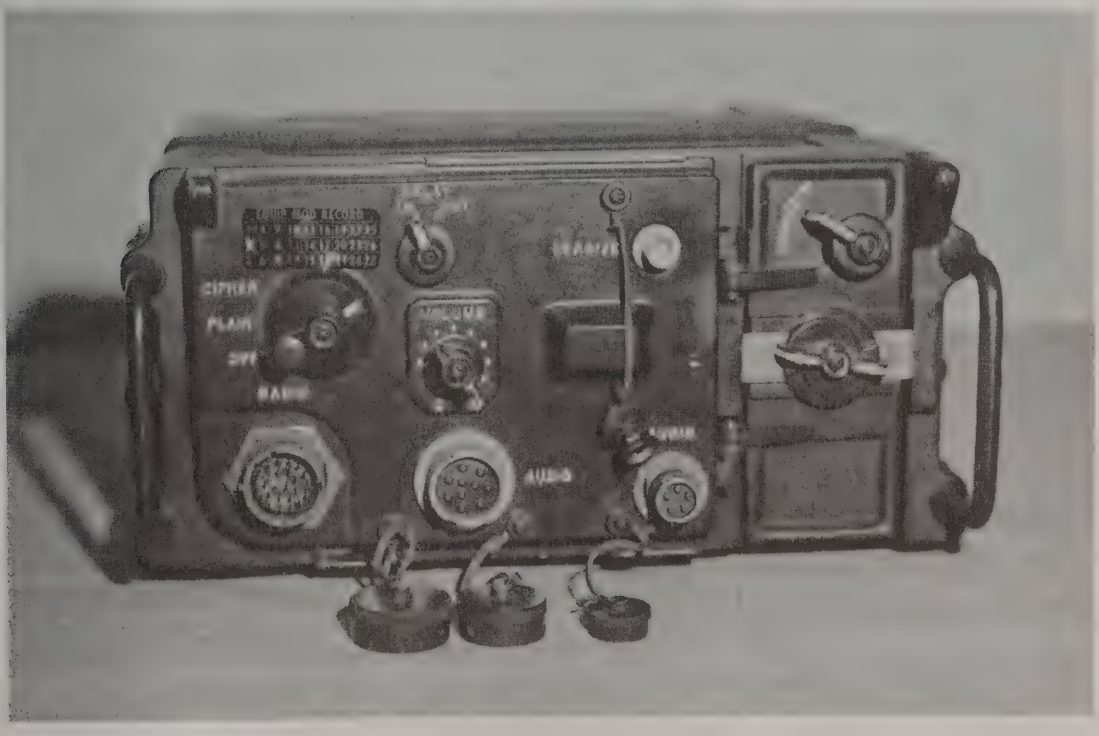


Figure 12-3. Speech Security Equipment, TSEC/KY-38.

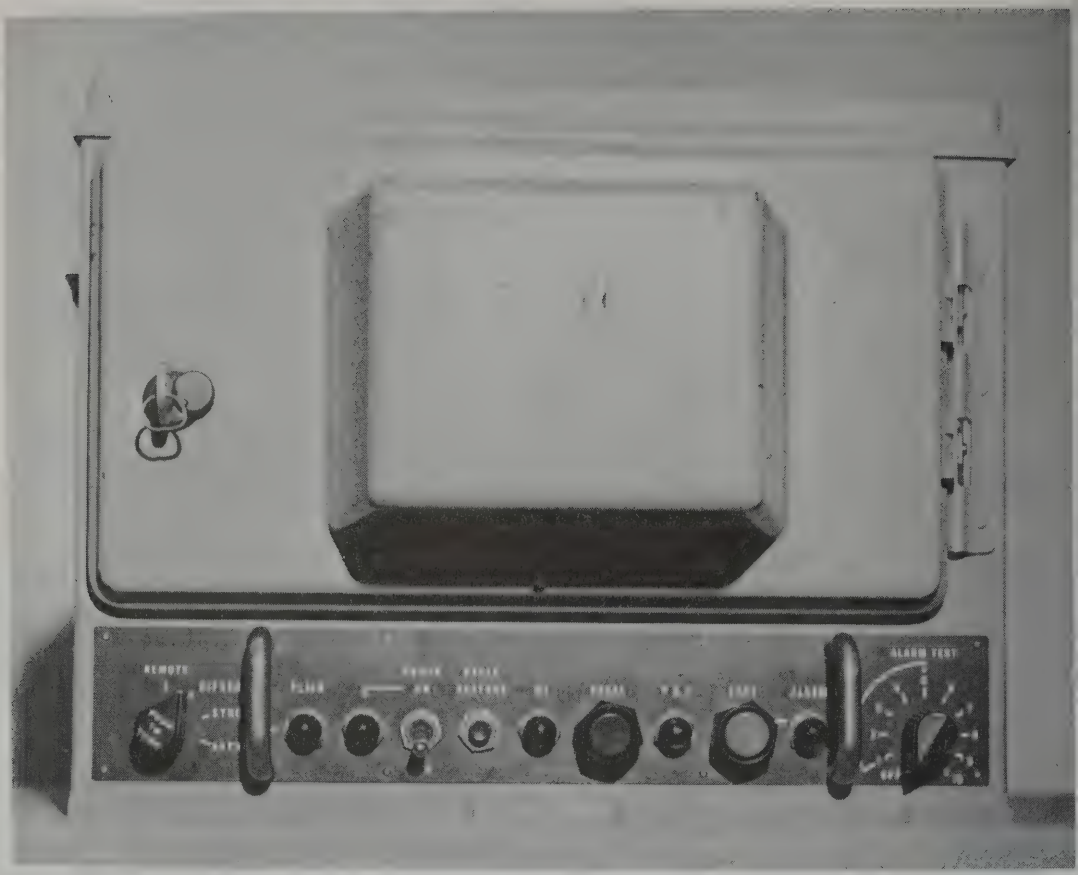


Figure 12-4. Teletype Security Equipment, TSEC/KW-7.

CHAPTER 13

RADIOTELEPHONE PROCEDURE

13-1. GENERAL

This chapter describes the basic procedure used for radiotelephone communications. This procedure is designed to expedite the transmission of messages and reduce the number of errors by providing a precise and uniform method of handling radiotelephone traffic. It helps to overcome individual variety caused by voice quality, pronunciation, dialect, etc., and facilitates radiotelephone communications for joint and combined operations. Since personnel other than trained operators frequently operate radiotelephone equipment, all personnel must be cautioned that unencrypted radiotelephone transmissions are subject to enemy interception and, therefore, provide no security. Detailed information on radiotelephone procedure is contained in Allied Communications Publication (ACP) 125D.

13-2. TRANSMISSION SECURITY

Adherence to prescribed radiotelephone procedure is mandatory. Unauthorized departures from, or variations in, prescribed procedure often create confusion, reduce reliability and speed of communications, or violate security precautions. Such departures or variations are prohibited. Initiative and common sense should be used when the prescribed procedure does not cover a specific operating requirement. The following basic rules are essential to transmission security and shall be strictly enforced on all military radiotelephone circuits.

a. No transmission shall be made that has not been authorized by proper authority.

b. The following practices are specifically forbidden:

(1) Violation of radio silence.

(2) Unofficial conversation between operators.

(3) Transmitting on a directed net without permission. In a directed net, stations obtain permission from the net control station prior to transmitting a message to another station in the net with the exception of FLASH messages, which shall be sent direct.

(4) Excessive tuning and testing.

(5) Transmitting the operator's personal sign or name.

(6) Unauthorized use of plain language.

(7) Use of other than authorized prowords (see para 13-5).

(8) Unauthorized use of plain language in place of applicable prowords.

(9) Linkage or compromise of classified call signs by plain language disclosures or association with unclassified call signs.

(10) Profane, indecent, or obscene language.

c. The following practices are to be avoided:

(1) Using excessive transmitting power.

(2) Taking excessive time for tuning, changing frequency, or adjusting equipment.

(3) Transmitting at speeds beyond the capability of receiving operators.

13-3. OPERATING RULES

a. Plan all messages before transmitting, including writing them out in advance whenever possible.

b. Make transmissions clear, concise, and complete.

c. Hold or adjust the microphone to approximately 1/2 inch from the lips. Never shout or blow into the microphone. Speak clearly, slowly, in natural phrases, not word by word but pronounce each word distinctly. When the receiving operator must copy, allow

sufficient time for writing. Messages that must be delivered by the receiving operator to another person or that are preceded by the proword message (see para 13-5a) shall be written down.

d. Listen before transmitting to avoid interrupting other traffic.

e. Always assume that the enemy is listening.

13-4. PHONETIC ALPHABET AND NUMERALS

To avoid confusion and errors during radiotelephone transmissions, special procedures have been developed for pronouncing letters and numerals. These special procedures are the phonetic alphabet and phonetic numerals.

a. Phonetic Alphabet. To help identify the spoken letters of the alphabet, a set of easily understood words, the phonetic alphabet, has been adopted by the armed services. The phonetic alphabet is used by the operator to spell difficult words. The phonetic alphabet is a word alphabet and not a code. It is pronounced as indicated below. The accented syllables of each word are underlined.

Letter	Phonetic Word	Pronunciation	Letter	Phonetic Word	Pronunciation
A	ALFA	AL FAH	N	NOVEMBER	NO VEM BER
B	BRAVO	BRAH VOH	O	OSCAR	OSS CAH
C	CHARLIE	CHAR LEE or SHAR LEE	P	PAPA	PAH PAH
			Q	QUEBEC	KEH BECK
D	DELTA	DELL TAH	R	ROMEO	ROW ME OH
E	ECHO	ECK OH	S	SIERRA	SEE AIR RAH
F	FOXTROT	FOKS TROT	T	TANGO	TANG GO
G	GOLF	GOLF	U	UNIFORM	YOU NEE FORM or OO NEE FORM
H	HOTEL	HOH TELL			
I	INDIA	IN DEE AH	V	VICTOR	VIK TAH
J	JULIETT	JEW LEE ETT	W	WHISKEY	WISS KEY
K	KILO	KEY LOH	X	XRAY	ECKS RAY
L	LIMA	LEE MAH	Y	YANKEE	YANG KEY
M	MIKE	MIKE	Z	ZULU	ZOO LOO

(1) Difficult words or groups within the text of plain text messages may be spelled using the phonetic alphabet and preceded by the proword I SPELL. If the operator can pronounce the word to be spelled, he will do so before and after the spelling to identify the word.

Examples. 1. The operator is able to pronounce the word. ENEMY ARMOR SIGHTED IN VICINITY OF CAIRO--I SPELL--CHARLIE ALFA INDIA ROMEO OSCAR CAIRO--OVER.

2. The operator is unable to pronounce the word. PROCEED TO--I SPELL--ALFA TANGO QUEBEC UNIFORM ECHO--OVER.

(2) When a text is composed of pronounceable words, they will be spoken as such. When a text is encrypted, the groups, even though occasionally pronounceable, are to be transmitted by the phonetic equivalents of the individual letters and without the proword I SPELL.

Example. The encrypted group LUXOW is spoken as: LIMA UNIFORM XRAY OSCAR WHISKEY and counted as one group.

b. Phonetic Numerals. Numbers transmitted by radiotelephone are pronounced as shown below. The accented syllables are underlined.

NUMERAL	SPOKEN AS	NUMERAL	SPOKEN AS
Ø	ZE-RO	5	FIFE
1	WUN	6	SIX
2	TOO	7	SEV-EN
3	TREE	8	AIT
4	FOW-ER	9	NIN-ER

(1) To distinguish phonetic numerals from words similarly pronounced, the proword FIGURES may be used preceding such numbers.

(2) Numbers will be transmitted digit by digit, except that exact multiples of thousands may be spoken as such, using the pronunciation TOU-SAND. However, in all cases, the date-time group, time, map coordinates, and call sign suffixes will be spoken digit by digit.

Examples. 44--FOW-ER FOW-ER
7ØØØ--SEV-EN TOU-SAND
Time 12ØØ--TIME WUN TOO ZE-RO ZE-RO.

(3) The decimal point is pronounced as DAY-SEE-MAL.

Example. 123.4--WUN TOO TREE DAY-SEE-MAL FOW-ER.

13-5. PROWORDS AND THEIR MEANINGS

To keep voice transmissions as short and clear as possible, radio operators use procedure words, referred to as prowords, to take the place of long sentences. The prowords are selected words or phrases that have been assigned specific meanings. In no case shall a proword or combination of prowords be substituted for the textual component of a message. The use of other than authorized prowords is forbidden.

a. Selected Prowords. The following selected prowords are authorized for general use:

PROWORD	EXPLANATION
ALL AFTER	The part of the message to which I have reference is all after that which follows_____.
ALL BEFORE	The part of the message to which I have reference is all that which precedes_____.
AUTHENTICATE	The station called is to reply to the challenge that follows.
AUTHENTICATION IS	The transmission authentication of this message is _____.
BREAK	I hereby indicate the separation of the text from other parts of the message.
CORRECT	You are correct, or what you have transmitted is correct.
CORRECTION	An error has been made in this transmission. Transmission will continue with the last word correctly transmitted. (See para 13-10.)
	An error has been made in this transmission (or message indicated). The correct version is_____.

PROWORD	EXPLANATION
	That which follows is a corrected version in answer to your request for verification.
DISREGARD THIS TRANSMISSION--OUT	This transmission is in error. Disregard it. This proword shall not be used to cancel any message that has been completely transmitted and for which receipt or acknowledgement has been received.
DO NOT ANSWER	Stations called are not to answer this call, receipt for this message, or otherwise to transmit in connection with this transmission. When this proword is employed, the transmission shall be ended with the proword OUT. (See para 13-14.)
EXEMPT	The addressees immediately following are exempted from the collective call.
FIGURES	Numerals or numbers follow.
FROM	The originator of this message is indicated by the address designator immediately following.
GROUPS	This message contains the number of groups indicated by the numeral following.
GROUP NO COUNT	The groups in this message have not been counted.
I AUTHENTICATE	The group that follows is the reply to your challenge to authenticate.
INFO	The addressees immediately following are addressed for information.
I READ BACK	The following is my response to your instructions to read back.
I SAY AGAIN	I am repeating transmission or part indicated.
I SPELL	I shall spell the next word phonetically. (See para 13-3a.)
I VERIFY	That which follows has been verified at your request and is repeated. To be used only as a reply to VERIFY.
MESSAGE	A message that requires recording is about to follow. Transmitted immediately after the call. (This proword is not used on nets employed primarily for conveying messages. It is intended for use when messages are passed on tactical or reporting nets.)
MORE TO FOLLOW	Transmitting station has additional traffic for the receiving station.

PROWORD	EXPLANATION
NUMBER	Station serial number.
OUT	This is the end of my transmission to you and no answer is required or expected.
OVER	This is the end of my transmission to you and a response is necessary. Go ahead; transmit.
READ BACK	Repeat this entire transmission back to me exactly as received. (See para 13-11.)
RELAY (TO)	Transmit this message to all addressees (or addressees immediately following this proword). The address component is mandatory when this proword is used. (See para 13-13.)
ROGER	I have received your last transmission satisfactorily. (Will be used as an answer to a RADIO CHECK indicating reception is loud and clear.)
SAY AGAIN	Repeat all of your last transmission. Followed by identification data means: Repeat_____ (part indicated). May be used in conjunction with WORD AFTER, WORD BEFORE, ALL AFTER, and ALL BEFORE. (See para 13-9.)
SILENCE, SILENCE, SILENCE	Cease transmission immediately on this net. Silence will be maintained until lifted. (When an authentication system is in force, the transmission imposing silence is to be authenticated.)
SILENCE LIFTED	Silence is lifted. (When an authentication system is in force, the transmission lifting silence is to be authenticated.)
SPEAK SLOWER	Your transmission is too fast. Reduce speed of transmission.
THIS IS	This transmission is from the station whose designator immediately follows.
TIME	That which immediately follows is the time or date-time group of the message.
TO	The addressee(s) whose designation(s) immediately follow are addressed for action.
UNKNOWN STATION	The identity of the station with which I am attempting to establish communication is unknown.
VERIFY	Verify entire message (or part indicated) with the originator and send correct version. To be used only at the discretion of or by the addressee to which the questioned message was directed. (See para 13-12.)

WAIT	I must pause for a few seconds.
WAIT-OUT	I must pause longer than a few seconds.
WILCO	I have received your message, understand it, and will comply. To be used by the addressee. Since the meaning of ROGER is included in that of WILCO, the two prowords are never used together.
WORD AFTER	The word of the message to which I have reference is that which follows_____.
WORD BEFORE	The word of the message to which I have reference is that which precedes_____.
WORDS TWICE	Communication is difficult. Transmit (ting) each phrase (or each code group) twice. This proword may be used as an order, request, or as information. (See para 13-8b.)
WRONG	Your last transmission was incorrect. The correct version is _____.

b. Precedence Prowords. The following prowords are used to indicate the precedence of a transmitted message.(Additional information on message precedence is contained in AR 105-31, chapter 4.)

PROWORD	EXPLANATION
ROUTINE	Precedence Routine. Used for all types of messages that that justify transmission by electrical means, but are not of sufficient urgency or importance to require a higher precedence.
PRIORITY	Precedence Priority. Messages that require expeditious action by the addressees and/or furnish essential information for the conduct of operations in progress.
IMMEDIATE	Precedence Immediate. Messages that gravely affect the security of national and allied forces or populace and that require immediate delivery to the addressee.
FLASH	Precedence Flash. Initial enemy contact messages or operational combat messages of extreme urgency.

c. Radio Check Prowords. A station is understood to have good signal strength and readability unless otherwise notified. Strength of signals and readability will not be exchanged unless one station cannot clearly hear another station. A station that wishes to inform another of his signal strength and readability will do so by means of a short and concise report of actual reception such as "Weak but readable," "Loud but distorted," "Weak with interference," etc. The prowords listed below are for use when initiating and answering queries concerning signal strength and readability.

PROWORD	EXPLANATION
(1) General.	
RADIO CHECK	What is my signal strength and readability, i.e., how do you hear me?
ROGER	I have received your last transmission satisfactorily. The omission of comment on signal strength and readability is understood to mean that reception is loud and clear. If reception is other than loud and clear, it must be described with the prowords from (2) and (3) below.
NOTHING HEARD	To be used when no reply is received from a called station.
(2) Report of signal strength.	
LOUD	Your signal is very strong.
GOOD	Your signal strength is good.
WEAK	Your signal strength is weak.
VERY WEAK	Your signal strength is very weak.
FADING	At times your signal strength fades to such an extent that continuous reception cannot be relied upon.
(3) Report of readability.	
CLEAR	Excellent quality.
READABLE	Quality is satisfactory.
UNREADABLE	The quality of your transmission is so bad that I cannot read you.
DISTORTED	Having trouble reading you because your signal is distorted.
WITH INTERFERENCE	Having trouble reading you due to interference.
INTERMITTENT	Having trouble reading you because your signal is intermittent.

13-6. OPENING A NET

a. Abbreviated call signs shall not be used in establishing communications.

b. Before conducting regular traffic over radiotelephone circuits, it may be necessary to make contact with the other stations involved to be sure that communication is possible.

c. A radio net is a group of stations operating together. Control of the net is the responsibility of the net control station (NCS), which is normally the station serving the

highest headquarters within the net. An acting or alternate NCS is appointed by the NCS when it leaves the net temporarily. All other stations in the net are called subordinate stations. The following call signs and suffixes are used throughout the examples below:

AUBURN STRING--Net call sign.
AUBURN STRING 5--Net control station (NCS).
AUBURN STRING 6--Subordinate station.
AUBURN STRING 16--Subordinate station.
AUBURN STRING 26--Subordinate station.
DAMP LION 16--Subordinate station.
GAUDY HARPS 17--Subordinate station.

d. Establishment of a net shown in the following examples:

Note. In the following examples, optional words or phrases are in parentheses.

(1) Example 1.

(a) At a designated time, or when ready to establish the net, the NCS transmits:

AUBURN STRING--THIS IS AUBURN STRING 5--OVER.

(b) Each subordinate station then answers the initial transmission of the NCS in alphabetical and numerical order as follows:

(AUBURN STRING 5)--(THIS IS) AUBURN STRING 6--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 16--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 26--OVER.
(AUBURN STRING 5)--(THIS IS) DAMP LION 16--OVER.
(AUBURN STRING 5)--(THIS IS) GAUDY HARPS 17--OVER.

Note. Suffix numbers will be pronounced digit by digit, that is, WUN SIX, TREE SIX, etc.

(c) The NCS now calls the net to inform all stations that their transmissions have been heard and that he has no traffic for them.

(AUBURN STRING)--(THIS IS) AUBURN STRING 5--OUT.

or

(d) Once the net has been established and the NCS desires to authorize the use of abbreviated call signs, the NCS transmits:

(AUBURN STRING)--(THIS IS) AUBURN STRING 5--ABBREVIATED CALL SIGNS AUTHORIZED THIS NET--OUT.

(2) Example 2.

(a) In this example, the subordinate station, AUBURN STRING 26, is unable to answer the net call sign of the NCS in the proper sequence. The delinquent station, AUBURN STRING 26, would answer as the last subordinate station.

AUBURN STRING--(THIS IS) AUBURN STRING 5--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 6--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 16--OVER.

Note. At this time AUBURN STRING 26 cannot answer in order. DAMP LION 16, hearing no answer, waits approximately 5 seconds then answers in turn.

(AUBURN STRING 5)--(THIS IS) DAMP LION 16--OVER.
(AUBURN STRING 5)--(THIS IS) GAUDY HARPS 17--OVER.

Note. Once AUBURN STRING 26 misses his turn, he must wait until all stations have answered. If ready, he then would answer the call.

(AUBURN STRING 5)--(THIS IS) AUBURN STRING 26--OVER.
(AUBURN STRING)--(THIS IS) AUBURN STRING 5--OUT.

(b) If the delinquent station does not answer after the last station, the NCS would make the transmission shown below:
(AUBURN STRING)--(THIS IS) AUBURN STRING 5--ROGER.
AUBURN STRING 26--NOTHING HEARD--OUT

(c) The delinquent station, AUBURN STRING 26, when able to enter the net, will call the NCS and transmit:
AUBURN STRING 5--THIS IS AUBURN STRING 26--REPORTING INTO NET--OVER.
AUBURN STRING 5 having no traffic for AUBURN STRING 26 transmits:
(AUBURN STRING 26)--(THIS IS) AUBURN STRING 5--ROGER--OUT.

e. Establishment of a net, using the challenge and reply authentication system: This is one method that may be used. The method to be used may be prescribed by the unit CEOI or SOP.

(1) At a designated time, or when ready to establish the net, the NCS will make the following transmission indicating that authentication will be employed.
(AUBURN STRING)--(THIS IS)--AUBURN STRING 5--I AM PREPARED TO AUTHENTICATE--OVER.

(2) Each subordinate station then answers the initial transmission of the NCS in alphabetical and numerical order as follows: (AUBURN STRING 5)--

(THIS IS)--AUBURN STRING 6--AUTHENTICATE HOTEL ECHO--OVER.
(AUBURN STRING 6)--(THIS IS) AUBURN STRING 5 --AUTHENTICATION IS CHARLIE--AUTHENTICATE BRAVO GOLF--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 6--AUTHENTICATION IS WHISKEY--AUTHENTICATE MIKE ROMEO--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 16--AUTHENTICATION IS QUEBEC--AUTHENTICATE ECHO JULIETT--OVER.
(AUBURN STRING 5)--(THIS IS) AUBURN STRING 26--AUTHENTICATION IS FOXTROT--AUTHENTICATE VICTOR TANGO--OVER.
(AUBURN STRING 5)--(THIS IS) DAMP LION 16--AUTHENTICATION IS XRAY--AUTHENTICATE UNIFORM OSCAR--OVER.
(AUBURN STRING 5)--(THIS IS) GAUDY HARPS 17--AUTHENTICATION IS PAPA--OVER.

(3) The NCS now calls the net to inform all stations that their transmissions have been heard and that he has no traffic for them.
(AUBURN STRING)--(THIS IS) AUBURN STRING 5--OUT.

13-7. CLOSING THE RADIO NET

a. When the NCS has been instructed to close a voice net, the following procedure applies.

Example. The NCS sends CLOSE STATIONS in giving the order to close the net as follows:
(AUBURN) STRING--THIS IS (AUBURN) STRING 5--CLOSE STATIONS--OVER.

b. Subordinate stations answer in alphabetical and numerical order as follows:
(THIS IS)(AUBURN) STRING 6--ROGER--OUT.
(THIS IS)(AUBURN) STRING 16--ROGER--OUT.
(THIS IS)(AUBURN) STRING 26--ROGER--OUT.
(THIS IS)(DAMP) LION 16--ROGER--OUT
(THIS IS)(GAUDY) HARPS 17--ROGER--OUT.

Notes. 1. The proword WILCO may be used in lieu of the proword ROGER (used above) as a means of receipt.

2. When a net is being opened, all subordinate stations must use their complete call signs. When closing, subordinate stations may use the abbreviated call sign (shown above).

13-8. TRANSMITTING A MESSAGE

a. Communication Good. When communication reception is satisfactory, message parts (heading, text, and ending) need only be transmitted once, and preestablishment of contact is optional.

Example. (AUBURN) STRING 26--THIS IS (AUBURN) STRING 6--PROCEED TO OBJECTIVE BLUE--OVER.
AUBURN STRING 26, having received the above message satisfactorily, transmits:
(THIS IS) (AUBURN) STRING 26--ROGER--OUT.

b. Communication Difficult. When communication is difficult, or when a calling station wishes to determine whether the station to be called is ready to receive a message, a call is transmitted before attempting to transmit the message.

Example. AUBURN STRING 6 wishes to transmit a message to AUBURN STRING 16 and desires to know if AUBURN STRING 16 is ready to accept it; AUBURN STRING 6 transmits:
(AUBURN) STRING 16--THIS IS (AUBURN) STRING 6 (MESSAGE)--OVER.
AUBURN STRING 16, ready to accept the message, transmits:
(AUBURN) (STRING 6)--(THIS IS) (AUBURN) STRING 16 (SEND YOUR MESSAGE)--OVER.

WORDS TWICE is a proword to be used when communication is difficult. When communication is difficult, call signs should be transmitted twice. Phrases, words, or groups may be transmitted twice and indicated by use of the proword WORDS TWICE. Reception may be verified by use of the proword READ BACK. Under such conditions, a call normally is made to first establish contact unless stations are on a directed net, in which case stations should have indicated that they are ready to receive.

Example. AUBURN STRING 6--AUBURN STRING 6--THIS AUBURN STRING 16--AUBURN STRING 16 (MESSAGE)--OVER.
AUBURN STRING 16--AUBURN STRING 16--THIS IS AUBURN STRING 6--AUBURN STRING 6--(SEND YOUR MESSAGE)--OVER.
AUBURN STRING 6--AUBURN STRING 6--THIS IS AUBURN STRING 16--AUBURN STRING 16--WORDS TWICE--WORDS TWICE--PROCEED TO OBJECTIVE BLUE--PROCEED TO OBJECTIVE BLUE--READ BACK--OVER.
AUBURN STRING 16--AUBURN STRING 16--THIS IS AUBURN STRING 6--AUBURN STRING 6--WORDS TWICE--WORDS TWICE--I READ BACK--I READ BACK--PROCEED TO OBJECTIVE BLUE--PROCEED TO OBJECTIVE BLUE--OVER.
AUBURN STRING 16--AUBURN STRING 16--THIS IS AUBURN STRING 6--AUBURN STRING 6--CORRECT--OUT.

13-9. REPETITIONS

A receiving operator who has missed, or is not certain of, a part or parts of a message may request a repetition by one of the following methods. The transmission below will be used to illustrate various methods of requesting and answering repetitions.

Notes. 1. The proword SAY AGAIN used alone or in conjunction with ALL AFTER, ALL BEFORE, WORD AFTER, WORD BEFORE_____TO_____ are used for the purpose of identifying the parts requested.

2. The prowords I SAY AGAIN used alone or in conjection with the prowords in note 1 above, is used to identify the part being repeated.

Examples 1. (AUBURN) STRING 26--THIS IS (AUBURN) STRING 6--(MESSAGE)--ROAD TO SMITHVILLE CLEAR--PROCEED ON ASSIGNED MISSION--OVER.
If AUBURN STRING 26 missed the entire message, he would transmit:
(AUBURN) (STRING 6)--(THIS IS) (AUBURN) STRING 26--SAY AGAIN--OVER.

2. In response to the request of AUBURN STRING 26, AUBURN STRING 6 would transmit:

(AUBURN)(STRING 26)--(THIS IS)(AUBURN) STRING 6--I SAY AGAIN--(AUBURN) STRING 26 --THIS IS (AUBURN) STRING 6--(MESSAGE)--ROAD TO SMITHVILLE CLEAR--PROCEED ON ASSIGNED MISSION--OVER.

Note. When SAY AGAIN is used alone, everything is repeated including the call signs.

3. If AUBURN STRING 26 misses only the words of the message following CLEAR, he would request the missing part by transmitting:

(AUBURN) STRING 6--THIS IS (AUBURN) STRING 26--SAY AGAIN ALL AFTER CLEAR--OVER.

In response to this request of AUBURN STRING 26, AUBURN STRING 6 would transmit:

(AUBURN)(STRING 26)--THIS IS (AUBURN) STRING 6--I SAY AGAIN ALL AFTER CLEAR--PROCEED ON ASSIGNED MISSION--OVER.

4. If AUBURN STRING 26 is doubtful of all of the message before the word PROCEED, he can request the missing part by transmitting:

(AUBURN) STRING 6--THIS IS (AUBURN) STRING 26--SAY AGAIN ALL BEFORE PROCEED --OVER.

In response to this request AUBURN STRING 6 would transmit:

(AUBURN)(STRING 26)--(THIS IS)(AUBURN) STRING 6--I SAY AGAIN ALL BEFORE PROCEED--(AUBURN)(STRING 26)(THIS IS)(AUBURN) STRING 6(MESSAGE)--ROAD TO SMITHVILLE CLEAR--OVER.

5. If AUBURN STRING 26 missed the fifth word of the message, he would request a repetition of the missing word by transmitting:

(AUBURN)(STRING 6)--(THIS IS)(AUBURN) STRING 26--SAY AGAIN WORD AFTER CLEAR--OVER.

Note. The same procedure could also apply by using the proword WORD BEFORE with ON in above example.

6. If AUBURN STRING 26 missed the part of the message between SMITHVILLE and ASSIGNED, he would request a repetition by transmitting:

(AUBURN)(STRING 6)--(THIS IS)(AUBURN) STRING 26--SAY AGAIN SMITHVILLE TO ASSIGNED--OVER.

In response to the request of AUBURN STRING 26, AUBURN STRING 6 would transmit:

(AUBURN)(STRING 26)--(THIS IS)(AUBURN) STRING 6--I SAY AGAIN SMITHVILLE TO ASSIGNED--SMITHVILLE CLEAR--PROCEED ON ASSIGNED--OVER.

Note. When requesting repetition of parts of a message consisting of code groups or clear text, the code groups or words concerned will always be identified by repeating the adjacent words or code groups or by using the code group sequence number.

13-10. CORRECTION DURING TRANSMISSION

a. When an error is made by a transmitting operator the proword CORRECTION will be transmitted followed by the last word, group, proword, or phrase transmitted correctly. Transmission then continues.

Example. (AUBURN) STRING 26--THIS IS (AUBURN) STRING 6--AREA BRAVO MINED AND MARKED RESORT--CORRECTION--MARKED--REPORT LOCATION--OVER.

b. When an error in transmission is made but not discovered immediately, a correction may be made in the final instruction element provided that the ending sign has not been transmitted. When making such a correction the word, group, proword, or phrase must be identified properly.

Example. (AUBURN) STRING 26--THIS IS (AUBURN) STRING 6--TRUCK CONVOY WILL ARRIVE 16ØØ--CLASS FIVE SUPPLIES ABOARD--CORRECTION WORD AFTER ARRIVE--18ØØ--OVER.

Notes.
1. The following prowords are used in conjunction with the proword CORRECTION to identify the part to be corrected: WORD AFTER, WORD BEFORE, ALL AFTER, and ALL BEFORE.
2. During the transmission of a message and before the transmission of the ending proword OVER or OUT, the transmission may be canceled by the use of the proword DISREGARD THIS TRANSMISSION--OUT. A message that has been transmitted completely may be canceled only by another message.

13-11. READ BACK MESSAGE

a. If it is desired that a message or a part of a message be read back, the proword READ BACK and identifying data will be transmitted immediately following the call. Uses of READ BACK are illustrated in the following:

Example 1. AUBURN STRING 6 has a message for AUBURN STRING 36. AUBURN STRING 6 directs AUBURN STRING 36 to read back to him the entire transmission exactly as it was received. AUBURN STRING 6 transmits:

(AUBURN) (STRING 6)--(THIS IS) AUBURN STRING 36--I READ BACK--(AUBURN) STRING 36--THIS IS (AUBURN) STRING 6--READ BACK--ROUTINE--TIME WUN FIFE ZERO NINER WUN ZERO SIERRA--GROUPS 5 BREAK--ALFA FOXTROT--TANGO ROMEO--FOXTROT JULIETT--OSCAR KILO--PAPA NOVEMBER--OVER.

b. AUBURN STRING 36 has read back the message of AUBURN STRING 6 correctly. AUBURN STRING 6 transmits:

(AUBURN) (STRING 36)--(THIS IS) (AUBURN) STRING 6--CORRECT--OUT.

Note. The proword CORRECT is used by the originator as a method of receipt. Its use indicates to the addressee that the message or part of a message read back by the addressee was exactly as transmitted by the originator.

Example 2. Assume that AUBURN STRING 36, in response to the instructions of AUBURN STRING 6 to READ BACK the message, reads the third group of the message back incorrectly. Detecting this error, AUBURN STRING 6 transmits:

(AUBURN) (STRING 36)--(THIS IS) (AUBURN) STRING 6--WRONG--WORD AFTER TANGO ROMEO--FOXTROT JULIETT--OVER.

c. In response to the above transmission of AUBURN STRING 6, AUBURN STRING 36 transmits:

(AUBURN) (STRING 6)--(THIS IS) (AUBURN) STRING 36--WORD AFTER TANGO ROMEO--FOXTROT JULIETT--OVER.

d. AUBURN STRING 6 receives the transmission of AUBURN STRING 36 correctly and transmits:

(AUBURN) (STRING 36)--(THIS IS) (AUBURN) STRING 6--CORRECT--OUT.

Note. A READ BACK of any part of a message may be requested by identifying the part.

13-12. VERIFICATION

a. When verification of a message or a part thereof has been requested by an addressee, the originating station will verify with the originator and send the correct version.

Example. AUBURN STRING 6 transmits the following message to AUBURN STRING 36.

(AUBURN) STRING 36--(THIS IS) (AUBURN) STRING 6 COVER WELDON ROAD UNTIL WUN FOUR ZERO ZERO HOURS--OVER.

b. AUBURN STRING 36 desires AUBURN STRING 6 to verify the name of the road, he transmits:

(AUBURN)(STRING 6)--(THIS IS)(AUBURN) STRING 36--VERIFY WORD AFTER COVER--OVER.

Note. This verification may have been requested by using--VERIFY WORD BEFORE ROAD--.

c. Assume that the originator has checked the message and found the road name to be correct, AUBURN STRING 6 transmits:

(AUBURN)(STRING 36)--(THIS IS)(AUBURN) STRING 6--I VERIFY WORD AFTER COVER--WELDON--OVER.

d. Assume that the originator has checked the message and found the road name to be incorrect. WELDON ROAD should have been MARK ROAD. AUBURN 6 transmits:

(AUBURN)(STRING 36)--(THIS IS)(AUBURN) STRING 6--CORRECTION--WORD AFTER COVER--MARK--OVER.

13-13. RELAY

a. The proword RELAY used alone indicates that the station called is to relay the message to the station indicated.

Example. AUBURN STRING 6 has a message for AUBURN STRING 26 that has to be relayed through AUBURN STRING 16. AUBURN STRING 6 transmits:

(AUBURN) STRING 16--THIS IS (AUBURN) STRING 6--RELAY--FROM (AUBURN) STRING 6--TO (AUBURN) STRING 26--RETURN TO ASSEMBLY AREA BLUE--OVER.

b. If AUBURN STRING 16 receives the message with its relay instructions without difficulty, AUBURN STRING 16 transmits:

(AUBURN)(STRING 6)--(THIS IS)(AUBURN) STRING 16--ROGER (WILCO may be used)--OUT.

c. AUBURN STRING 16 would then call AUBURN STRING 26 and transmit:

(AUBURN) STRING 26--THIS IS (AUBURN) STRING 16--FROM AUBURN STRING 6--TO (AUBURN) STRING 26--RETURN TO ASSEMBLY AREA BLUE--OVER.

AUBURN STRING 26 would reply:

(AUBURN) STRING 16--THIS IS (AUBURN) STRING 26 ROGER (or WILCO) OUT.

Note. Relay instructions in multiple-address messages may be further defined through the use of the prowords TO (action) and INFO (information) followed by appropriate addressees when required.

13-14. DO NOT ANSWER

When it is imperative that called stations do not answer a transmission, the proword DO NOT ANSWER will be transmitted immediately following the call and the complete transmission will be sent twice, the full transmission ending with the proword OUT.

Example. AUBURN STRING 6 has a message for AUBURN STRING 16 and for security reasons does not want AUBURN STRING 16 to answer his call or receipt for the message. AUBURN STRING 6 transmits:

(AUBURN) STRING 16--THIS IS (AUBURN) STRING 6--MESSAGE--DO NOT ANSWER--TIME WUN FIFE ZERO SEVEN TREE FIFE SIERRA--EXECUTE PLAN ALFA--I SAY AGAIN--(AUBURN) STRING 16--THIS IS (AUBURN) STRING 6--MESSAGE--DO NOT ANSWER--TIME WUN FIFE ZERO SEVEN TREE FIFE SIERRA--EXECUTE PLAN ALFA--OUT.

Note. In transmission of a DO NOT ANSWER message, the entire transmission is sent twice. The repetition is preceded by the proword I SAY AGAIN.

13-15. ACKNOWLEDGEMENT OF MESSAGES

a. It is the prerogative of the originator to request an acknowledgement to a message from any or all addressees of that message. The request for an acknowledgement is normally included in the text of that message. If the message has been transmitted the request for acknowledgement will constitute a new message. Acknowledgements are originated only by the addressee to whom the request for acknowledgement was made.

Example 1. AUBURN STRING 6 has an "acknowledgement" message for AUBURN STRING 26. In this situation, AUBURN STRING 6 transmits:

(AUBURN) STRING 26--THIS IS (AUBURN) STRING 6--MESSAGE--TIME WUN FIFE ZERO NINER FIFE FIFE SIERRA--MOVE TO ALTERNATE POSITION--ACKNOWLEDGE--OVER.

Note. The originator sends the word ACKNOWLEDGE as the last word of the text as shown above.

b. The addressee, represented by the call sign and suffix AUBURN STRING 26, is operating his own radio set. AUBURN STRING 26 acknowledges by transmitting:

(THIS IS) (AUBURN) STRING 26--ACKNOWLEDGE--OUT.

Example 2. Assume that the addressee AUBURN STRING 26 is not close to the radio operator. In this situation, AUBURN STRING 26 ALFA transmits:

(THIS IS) (AUBURN) STRING 26 ALFA--ROGER--OUT.

c. When the addressee is ready to acknowledge, he informs the operator who transmits:

(AUBURN) STRING 6--THIS IS (AUBURN) STRING 26 ALFA YOUR WUN FIFE ZERO NINER FIFE FIFE SIERRA ACKNOWLEDGED TIME WUN FIFE WUN ZERO ZERO FIFE--OVER.

d. AUBURN STRING 6 has received the acknowledgement of his message, so he now transmits:

(THIS IS) (AUBURN) STRING 6--ROGER--OUT.

CHAPTER 14

TELEPHONE AND SWITCHBOARD PROCEDURES

14-1. GENERAL

In order to effectively utilize the wire communications available to a unit, all persons who use this means of communication must be familiar with the proper procedure and techniques involved in its operation.

14-2. TELEPHONE DIRECTORY

a. General. The purpose of the military telephone directory is to simplify and expedite communications over a field telephone system. The telephone directory consists of two parts, directory names and directory numbers. Telephone directory names are assigned to organizations normally equipped with switchboards. These names are permanent and are changed only when there is a possibility of confusion with directory names of other divisions or units. They are not meant to provide security. Command and staff officers and installations not normally equipped with a switchboard are assigned a telephone directory number. The telephone directory names and numbers are included in the CEOI by the C-E officer of the division or of a higher command.

b. Directory Names. Directory names of all major units in a division begin with the same letter. They are simple, easy to pronounce words that are easily understood when spoken over the telephone. Separate battalions and companies are assigned separate directory names. Units at company level use the directory name of their battalion plus a suffix such as ALFA, BRAVO, etc., or RED, BLUE, etc. Directory names should not be used alone but always in conjunction with the appropriate directory number or identification of the installation being called.

c. Directory Numbers. Telephone directory numbers, once assigned, are not changed. To prevent confusion, the same number is prescribed for similar officers and offices throughout the command. Telephones not assigned a directory number are identified by an appropriate abbreviation or word description of the installation.

14-3. TELEPHONE OPERATION

The telephone is used to provide direct communication between two or more individuals. Conversations should be as short as possible. Written messages should not be transmitted by telephone unless it is unavoidable or speed is essential.

a. Precedence of Calls. There are two types of telephone calls on tactical switchboards, PRIORITY and ROUTINE.

(1) A priority call is one that is given precedence over existing circuits to the extent that it warrants interruption of a connection already made. However, one priority call will not normally interrupt another priority call already in progress. Priority calls are reserved for reports containing information that may materially affect plans or change a course of action, such as initial contact with the enemy, amplifying or subsequent enemy contact reports, and artillery fire missions. Normally, only specified extensions and personnel designated by the commander are authorized to place priority calls. However, in an emergency, such as a fire or crash, anyone may place a priority call.

(2) Routine calls have no precedence but are handled in the order received by the operator. Routine calls constitute the bulk of the traffic handled over a military wire system. These calls may contain routine information, which, although important, does not require special handling. All personnel using the military telephone system are authorized to place routine calls.

b. Placing Calls. Before placing a telephone call the calling party must refer to the telephone directory. Switchboard operators should not be required to look up telephone directory names and numbers for the calling party.

(1) In placing a priority call, the calling party initiates the call, using the operating phrase PRIORITY CALL FOR _____. He then announces the called party's telephone directory name and number followed by the operating phrase THIS IS, and his official designation.

Example. A priority call from the liaison officer, 2d Bn, 10th Armor, to the battalion commander would be announced to the switchboard operator as: PRIORITY CALL FOR DEXTER 6--THIS IS DEXTER 23.

(2) In placing a routine call, the calling party announces to the switchboard operator the directory name and number of the called party.

Example. A routine call from the commanding officer of Company A, 2d Bn, 10th Armor, to the battalion S3 would be announced to the switchboard operator as: DEXTER 3. A call for an unnumbered telephone, such as the battalion OP, 2d Bn, 10th Armor, would be announced to the switchboard operator as: DEXTER OP.

c. Response. In response to telephone calls, the answering party should state the directory name and number of the telephone, for example: DEXTER 6, DEXTER 3, or DEXTER OPERATOR.

d. Conversations. The procedure in person-to-person conversations, other than that used in placing and answering the call, follows no particular pattern of operating words and phrases. The parties connected use normal conversational language. To obtain maximum benefit from the military telephone system, person-to-person conversations should be well thought out before the call is placed. The use of prepared notes is recommended.

e. Ring Off. Parties on tactical switchboards should signal the operator when the call is finished.

14-4. SWITCHBOARD OPERATIONS

In order to establish and maintain an efficient wire system, there are certain principles the switchboard operator must follow.

a. Accuracy and Courtesy. Accuracy, speed, and courtesy are the three principles that should guide an operator. The efficient operation of the switchboard depends on promptness in answering calls and ensuring that the required connections are readily made. Politeness and tact on the part of the switchboard operator are most important. Parties should be made to feel that the operator is doing everything he can to get the call connected quickly. Operators must never give away to irritation.

b. Clear Speech. Operators should use a quiet "tone of voice" speaking directly into the microphone and pronouncing each syllable distinctly. The operator should refrain from any tendency to talk too rapidly or loudly. A rising inflection should be used when asking or implying a question. The authorized phonetic alphabet and numerals will be used when necessary. It is always possible that words or figures that sound alike may be confused. For this reason an operator, after repeating a requested name and/or number, should always pause before proceeding with the connection, thus giving the calling party an opportunity to make a correction.

14-5. SWITCHBOARD OPERATING PHRASES

The switchboard provides the wire system with flexibility and is the heart of the wire system. It is important that all switchboard operators and communication personnel use a standardized procedure in operating the switchboard. Allied Communications Publication ACP-134A provides detailed telephone switchboard operating procedure, including a complete list of words and phrases to be used by operators for all types of operations. A partial list of the more commonly used operating phrases are given in a through m, which follows:

a. DEXTER OPERATOR--In answering an incoming call, the switchboard operator announces his telephone directory name followed by the word OPERATOR.

b. DEXTER 6--On receiving the number from the calling party, the switchboard operator repeats the telephone directory name and number exactly as it was given him by the calling party.

c. NUMBER PLEASE--Phrase used by the operator to request number or repetition of a number that he has not understood.

d. THE LINE IS BUSY--Phrase used by the operator to report that a local telephone, for which he has received a call, is already in use or that all trunks to a desired switchboard are in use.

e. DEXTER PRIORITY CALL--On receiving a priority call, the switchboard operator repeats the telephone directory name and number followed by the phrase PRIORITY CALL.

f. THE NUMBER DOES NOT ANSWER--Phrase used by the operator to inform the calling party that the called telephone does not answer.

g. I WILL RING AGAIN--Phrase used by the operator when, in supervising a connection, he is informed that the called party did not answer.

h. WHAT IS YOUR NUMBER PLEASE?--Phrase used by the operator if, after supervising a connection, he is given a new number to call by one of the parties but is unable to identify the calling party.

i. HAVE YOU FINISHED?--Phrase used by the operator in supervising a connection. He repeats the challenge once more. If no reply is heard, the connection is then broken.

j. CONFERENCE CALL, DEXTER 5, DEXTER 3, DEXTER 2, I WILL CALL YOU BACK--Phrases used by the operator to indicate that he has understood correctly the numbers given to him by the calling party and that, after completing the calls, he will call the originator back as requested.

k. CONFERENCE CALL, DEXTER 5, DEXTER 3, DEXTER 2, ONE MOMENT PLEASE--Phrases used by the operator to indicate that he has understood correctly the number given to him and to hold the calling party on the line while the connection is being completed.

l. CONFERENCE CALL FOR YOU, ONE MOMENT PLEASE--Phrases used by the operator to inform the called party that he has a conference call for him and that there will be a delay in completing the connection.

m. YOUR CONFERENCE CALL, GO AHEAD, PLEASE--Phrases used by the operator to inform the calling party that the connection is complete and conversation may begin.

APPENDIX A

RADIO AND WIRE NETS

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Section III. RADIO AND WIRE NETS, H-SERIES TOE

The following diagrams are typical radio and wire nets using authorized TOE equipment. These radio and wire nets are depicted as taught at the US Army Armor School; however, the configuration of these nets may change in accordance with the requirements of the unit involved or the desires of the unit commander.

TANK, COMBAT, M60A1

AR/AAV, M551

RECOVERY VEHICLE, M88

CARRIER, PERSONNEL, M113

CARRIER, COMMAND AND RECONNAISSANCE, M114

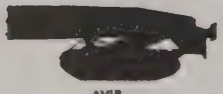
CARRIER, COMMAND POST, M577

¼-TON TRUCK

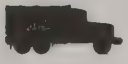
¼-TON TRUCK w/106-MM RR

¾-TON TRUCK

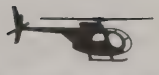
1¼-TON TRUCK M561



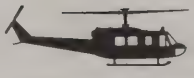
AVLB



2½-TON TRUCK



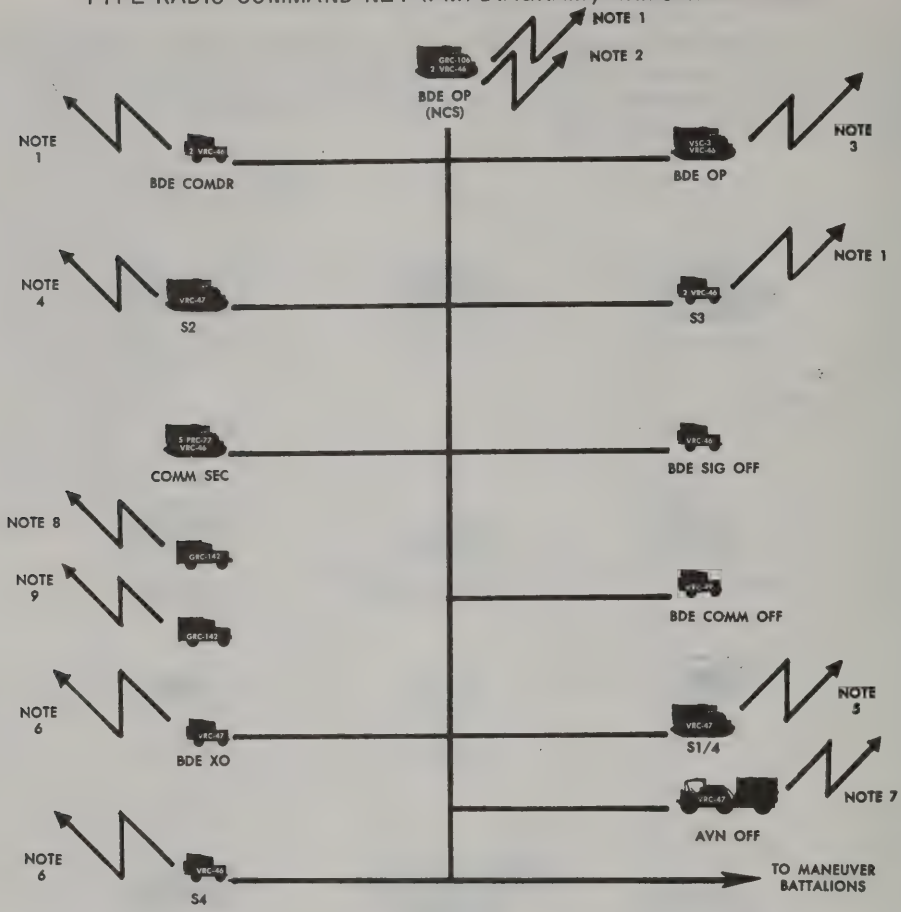
HELICOPTER, OBSERVATION, OH-6A



HELICOPTER, UTILITY, UH-1H

HELICOPTER, ATTACK, AH-1G

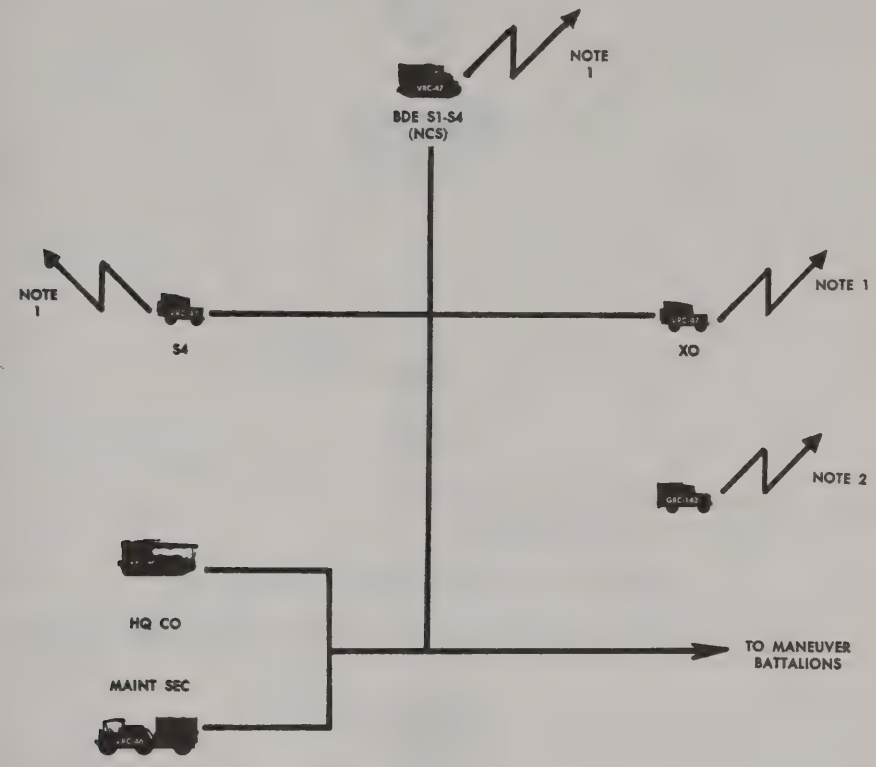
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED BRIGADE



Notes.
1. Operates in div CG/command net (FM).
2. Operates on DTOC net (AM).
3. NCS, bde RATT net (AM).
4. NCS, bde intel net (FM).
5. NCS, bde admin/log net (FM).
6. Operates in bde admin/log net (FM).
7. NCS, aviation section command net (FM).
8. Operates in div RATT net operations/intelligence.
9. Operates in div RATT net general purpose.

Figure A-1. Armored brigade command net (FM).

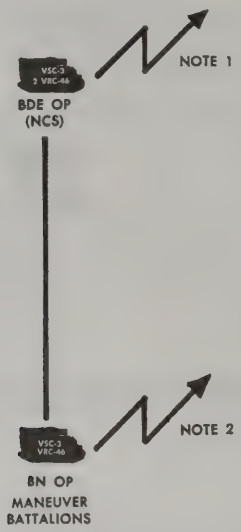
TYPE RADIO ADMINISTRATIVE-LOGISTICAL NET (FM) DIAGRAM, ARMORED BRIGADE



Notes. 1. Operates in bde command net (FM).
2. Operates in div RATT net 2.

Figure A-2. Armored brigade admin/log net (FM).

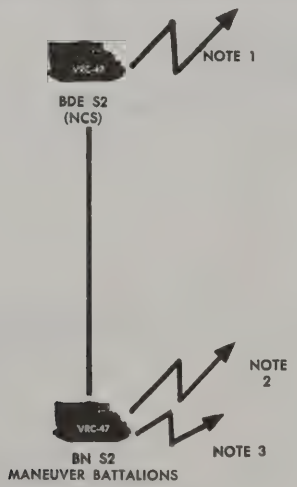
TYPE RATT NET (AM) DIAGRAM, ARMORED BRIGADE



Notes. 1. Operates in bde command net (FM).
2. Operates in bn command net (FM).

Figure A-3. Armored brigade RATT net (AM).

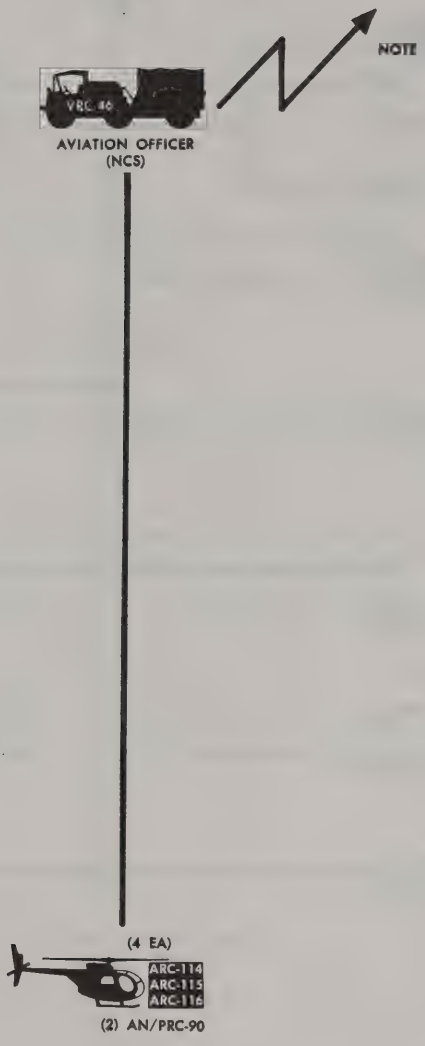
TYPE RADIO INTELLIGENCE NET (FM) DIAGRAM, ARMORED BRIGADE



Notes. 1. Operates in bde command net (FM).
2. Operates in bn command net (FM).
3. NCS, bn survl net (FM).

Figure A-4. Armored brigade intelligence net (FM).

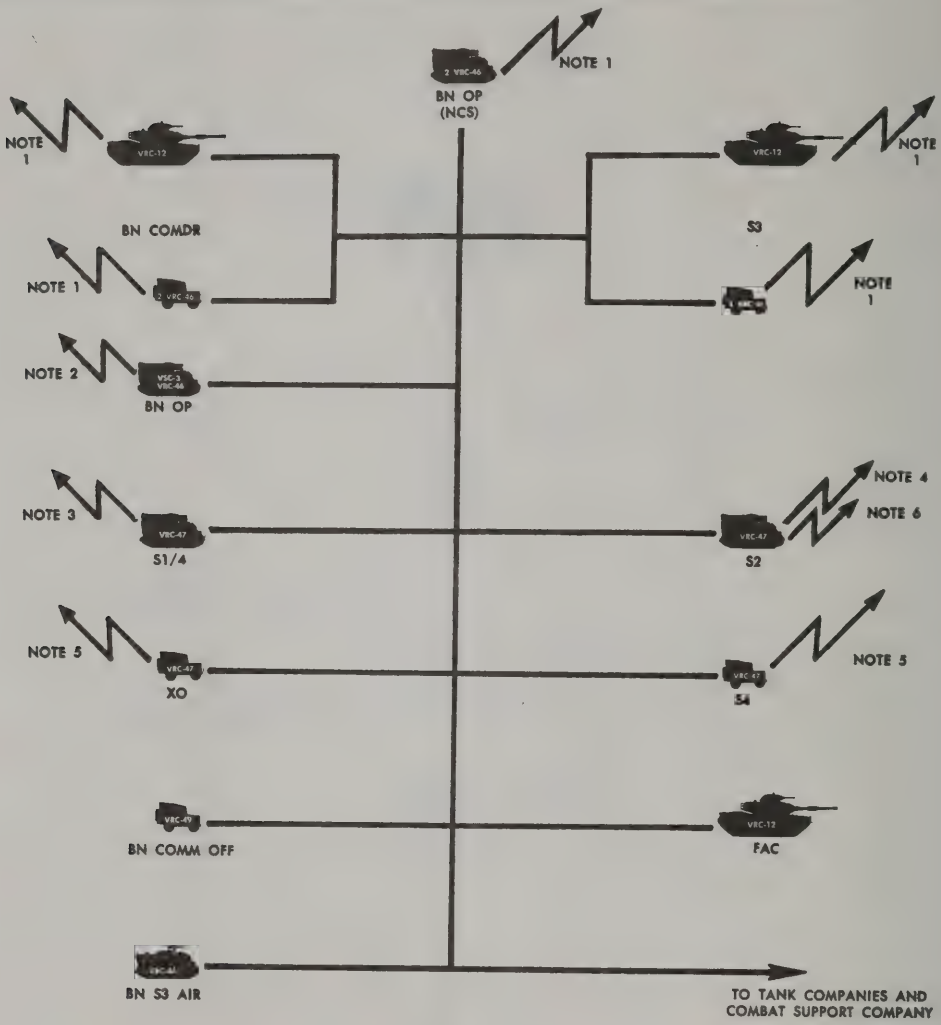
TYPE RADIO COMMAND NET (FM) DIAGRAM, AVIATION SECTION, ARMORED BRIGADE



Note. Operates in bde command net (FM).

Figure A-5. Armored brigade aviation section net (FM).

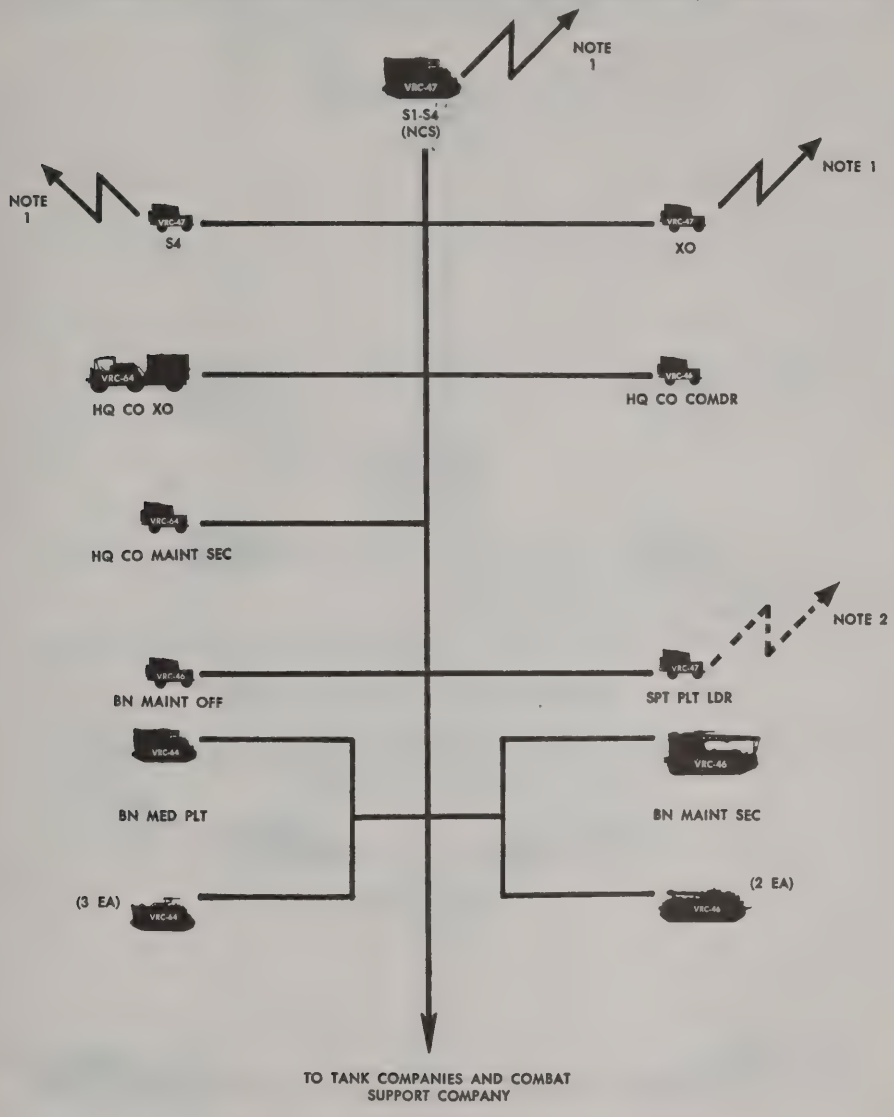
TYPE RADIO COMMAND NET (FM) DIAGRAM, TANK BATTALION



Notes. 1. Operates in bde command net (FM).
2. Operates in bde RATT net (AM).
3. NCS, bn admin/log net (FM).
4. Operates in bde intel net (FM).
5. Operates in bn admin/log net (FM).
6. NCS, bn survl net (FM) (established as required).

Figure A-6. Tank battalion command net (FM).

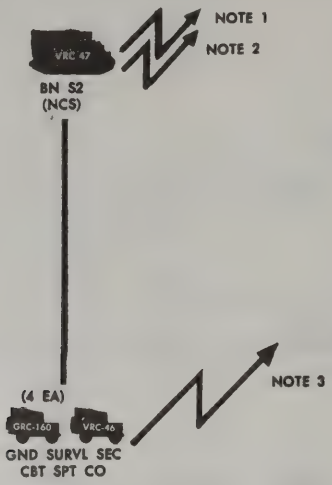
TYPE RADIO ADMINISTRATIVE/LOGISTICAL NET (FM) DIAGRAM, TANK BATTALION



Notes. 1. Operates in bn command net (FM).
2. Enters bde admin/log net (FM) as required.

Figure A-7. Tank battalion admin/log net (FM).

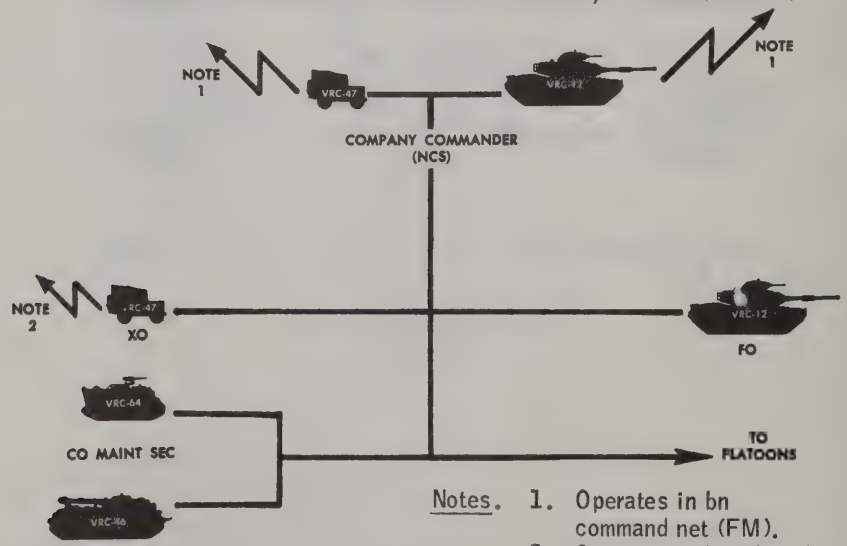
TYPE RADIO SURVEILLANCE NET (FM) DIAGRAM, TANK BATTALION
(ESTABLISHED AS REQUIRED)



Notes. 1. Operates in bn command net (FM).
2. Operates in bde intel net (FM).
3. Operates in company command net (FM).

Figure A-8. Surveillance net (FM).

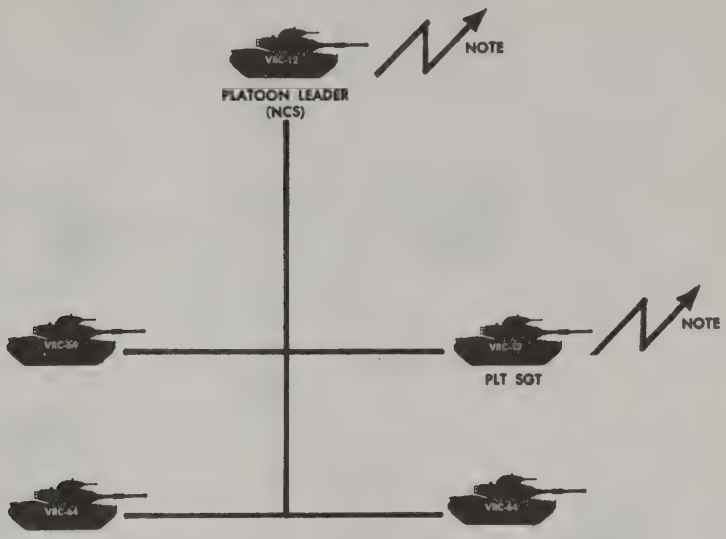
TYPE RADIO COMMAND NET (FM) DIAGRAM, TANK COMPANY



Notes. 1. Operates in bn command net (FM).
2. Operates in bn admin/log net (FM).

Figure A-9. Tank company command net (FM).

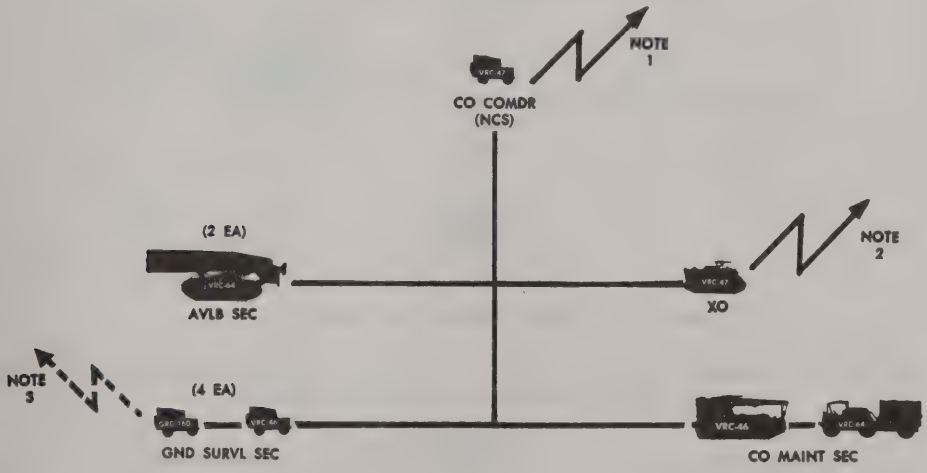
TYPE RADIO COMMAND NET (FM), TANK PLATOON



Note. Operates in company command net (FM).

Figure A-10. Tank platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, COMBAT SUPPORT COMPANY, TANK BATTALION



Notes. 1. Operates in bn command net (FM).
2. Operates in bn admin/log net (FM).
3. May be directed to operate in bn survl net (FM).

Figure A-11. Combat support company command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, SCOUT PLATOON, COMBAT SUPPORT COMPANY, TANK BATTALION

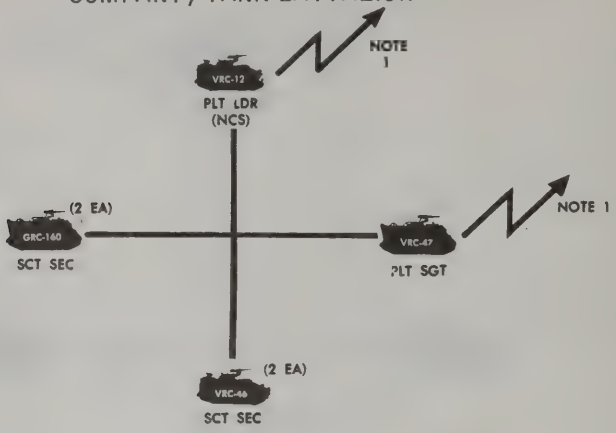


Figure A-12. 2d Platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, MORTAR PLATOON, COMBAT SUPPORT COMPANY TANK BATTALION

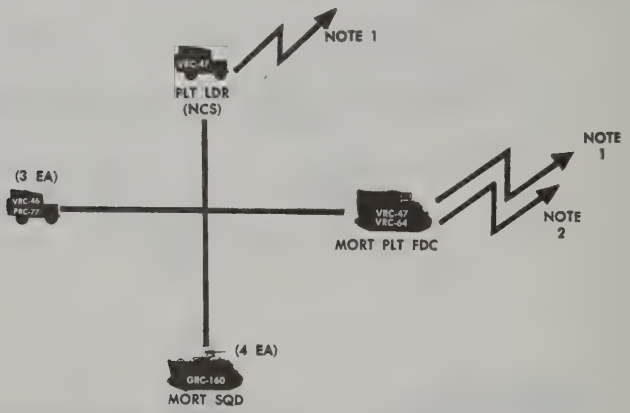


Figure A-13. Motor platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, REDEYE SECTION, COMBAT SUPPORT COMPANY, TANK BATTALION

Notes. 1. Operates in bn command net (FM).
2. Operates in arty bn FD net (FM).

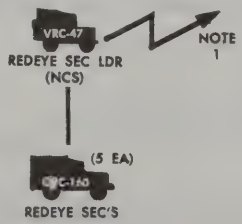
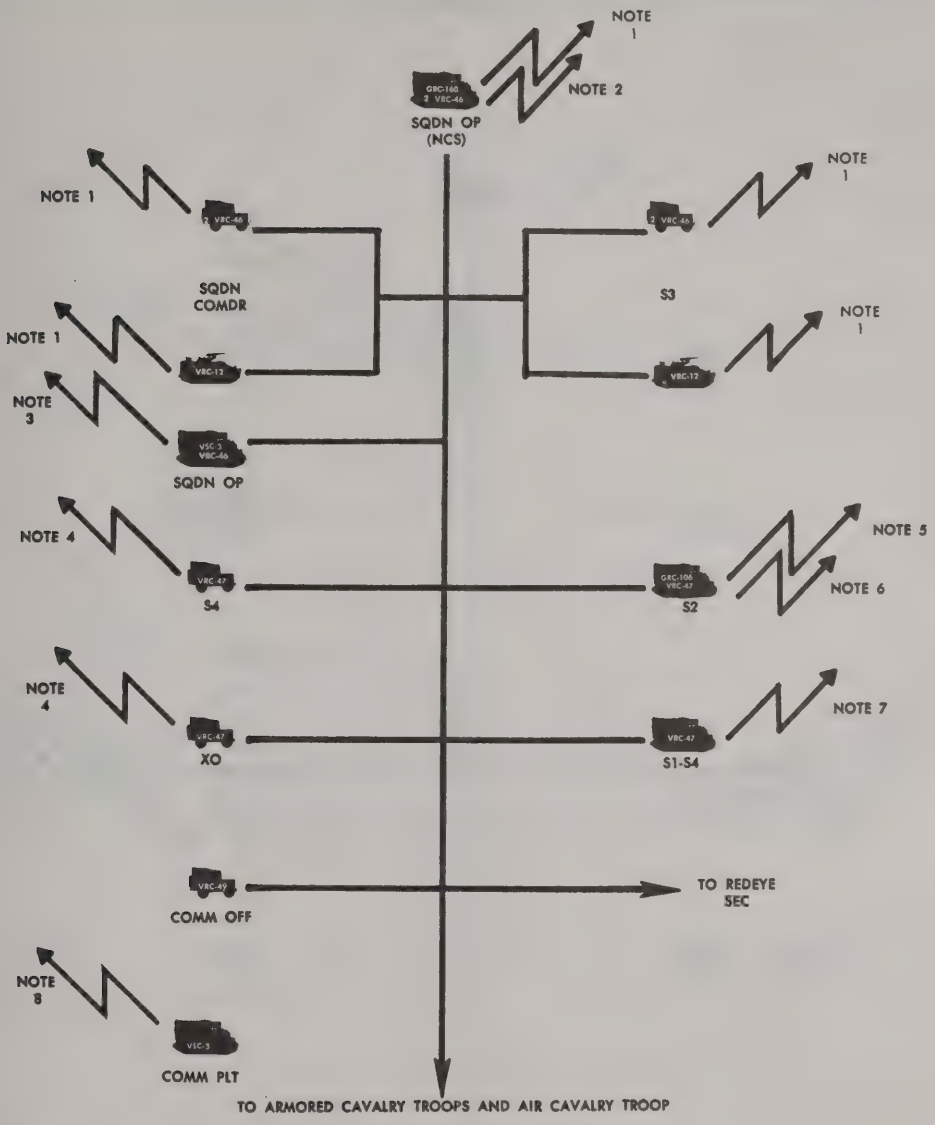


Figure A-14. Redeye section command net (FM).

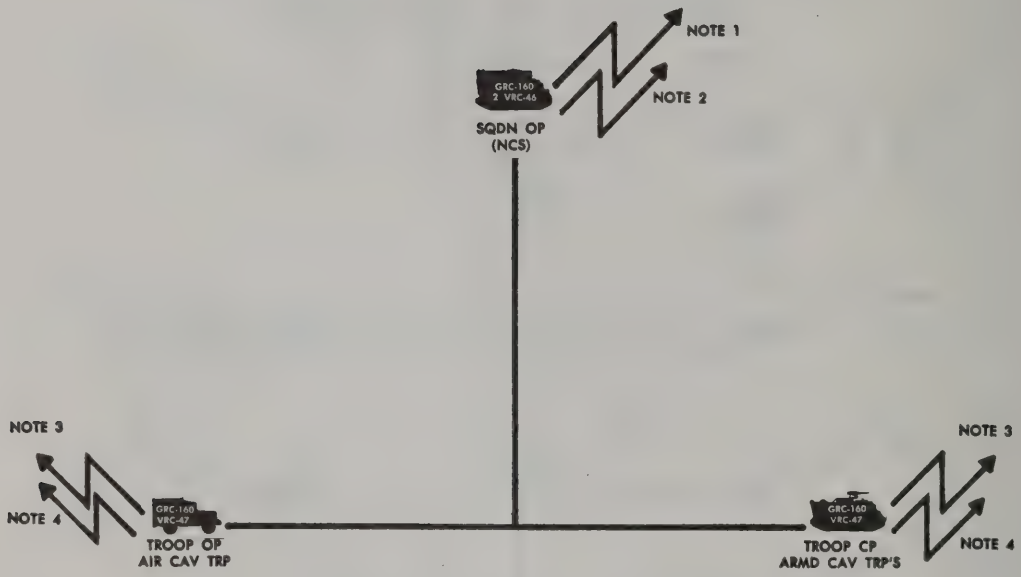
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY SQUADRON



Notes.
1. Operates in div CG/command net (FM).
2. NCS, sqdn command net (AM).
3. Operates in div RATT net 1.
4. Operates in sqdn admin/log net (FM).
5. Operates in DTOC net (AM).
6. NCS, sqdn intel net (FM).
7. NCS, sqdn admin/log net (FM).
8. Operates in div RATT net 2.

Figure A-15. Squadron command net (FM).

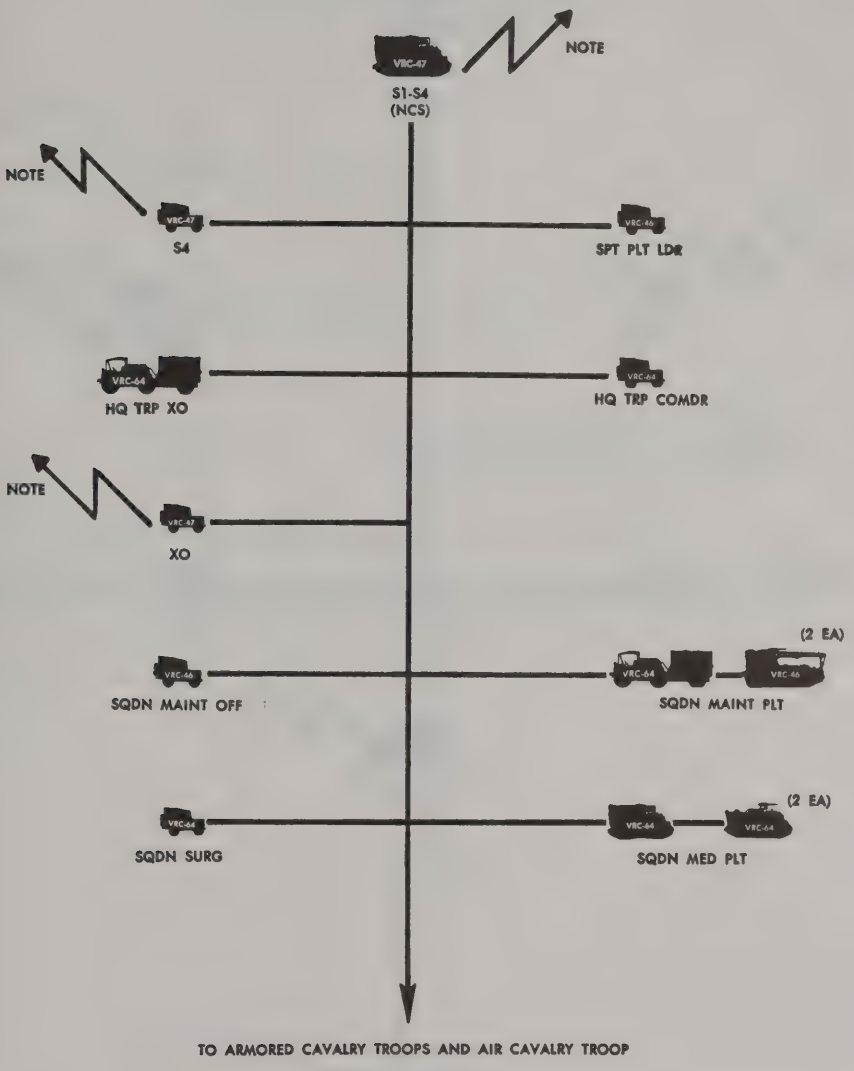
TYPE RADIO COMMAND NET (AM) DIAGRAM, ARMORED CAVALRY SQUADRON (DIVISION)



Notes. 1. NCS, sqdn command net (FM).
2. Operates in div CG command net (FM).
3. Operates in sqdn command net (FM).
4. NCS, trp command net (FM).

Figure A-16. Squadron command net (AM).

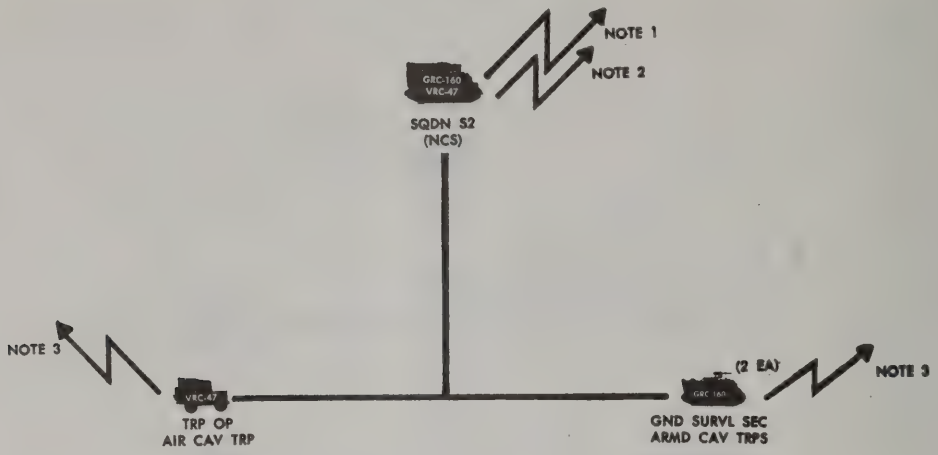
TYPE RADIO ADMINISTRATIVE/LOGISTICAL NET (FM) DIAGRAM, ARMORED CAVALRY SQUADRON



Note. Operates in sqdn command net (FM).

Figure A-17. Squadron admin/log net (FM).

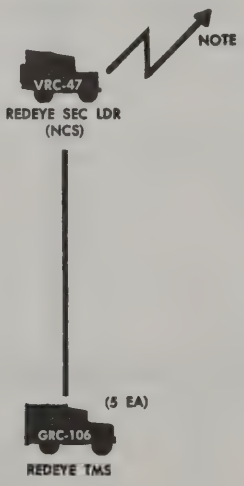
TYPE RADIO INTELLIGENCE NET (FM), ARMORED CAVALRY SQUADRON (DIVISION)



Notes. 1. Operates in DTOC net (AM).
2. Operates in sqdn command net (FM).
3. Operates in trp command net (FM).

Figure A-18. Squadron intelligence net (FM).

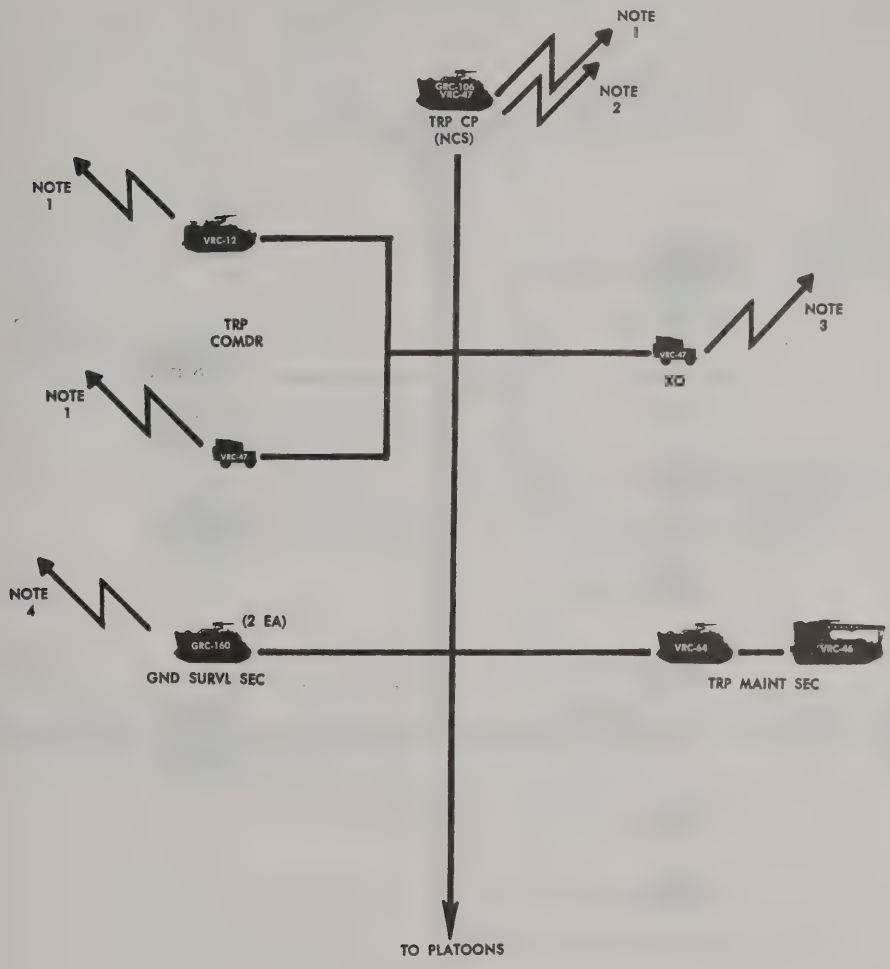
TYPE RADIO COMMAND NET (FM) DIAGRAM, REDEYE SECTION, ARMORED CAVALRY SQUADRON (DIVISION)



Note. Operates in sqdn command net (FM).

Figure A-19. Redeye section command net (FM).

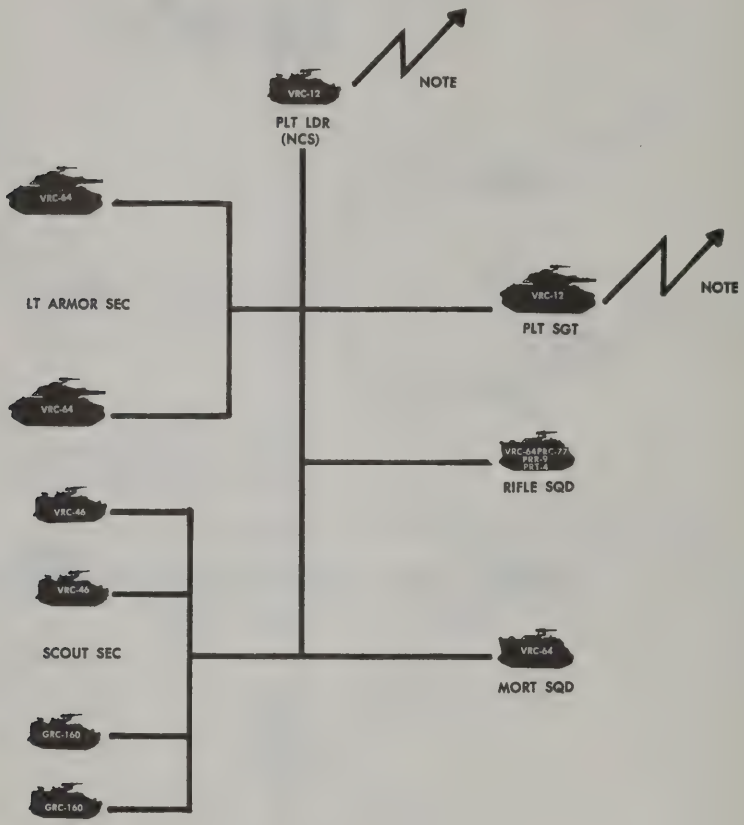
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)



Notes. 1. Operates in sqdn command net (FM).
2. Operates in sqdn command net (AM).
3. Operates in sqdn admin/log net (FM).
4. Enters sqdn intel net (FM) as required.

Figure A-20. Armored cavalry troop command net (FM).

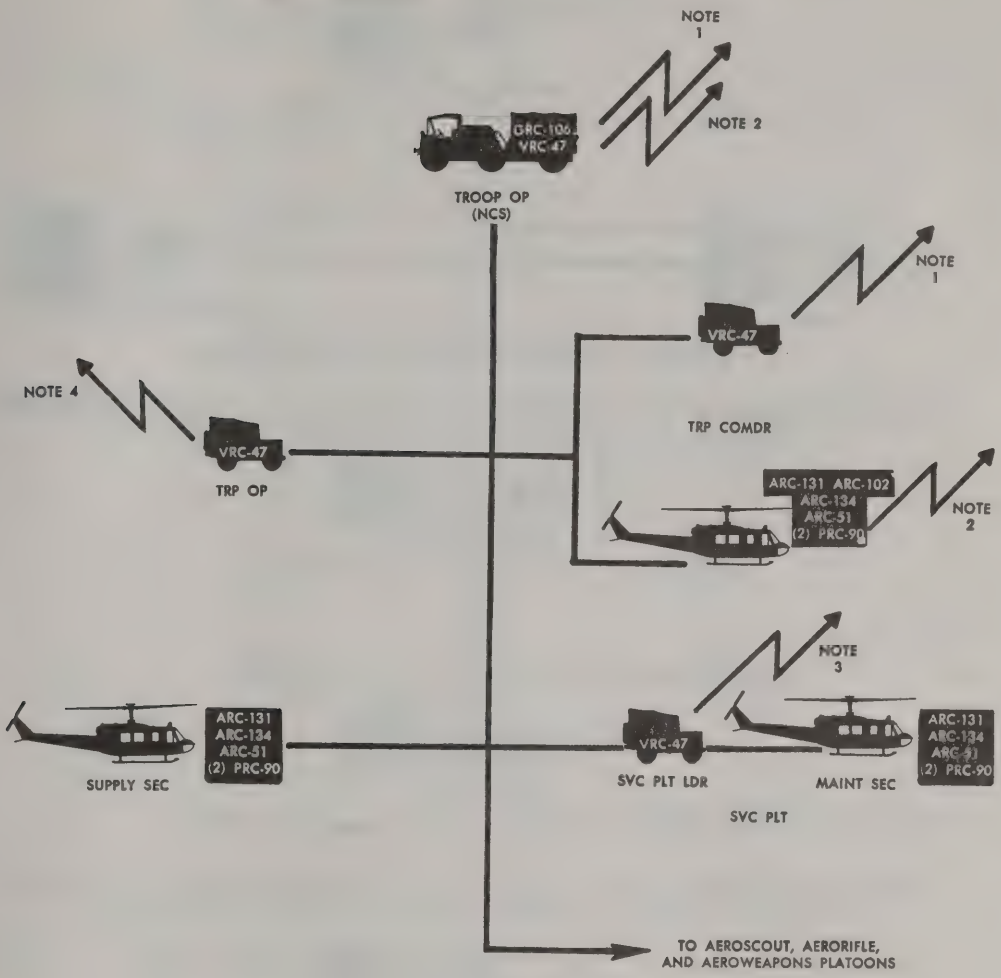
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY PLATOON, ARMORED CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)



Note. Operates in troop command net (FM).

Figure A-21. Armored cavalry platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, AIR CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)



Notes. 1. Operates in sqdn command net (FM).
2. Operates in sqdn command net (AM).
3. Operates in sqdn admin/log net (FM).
4. Operates in sqdn intel net (FM).

Figure A-22. Air cavalry troop command net (FM).

TYPE RADIO COMMAND NET (UHF) DIAGRAM, AEROSCOUT PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)

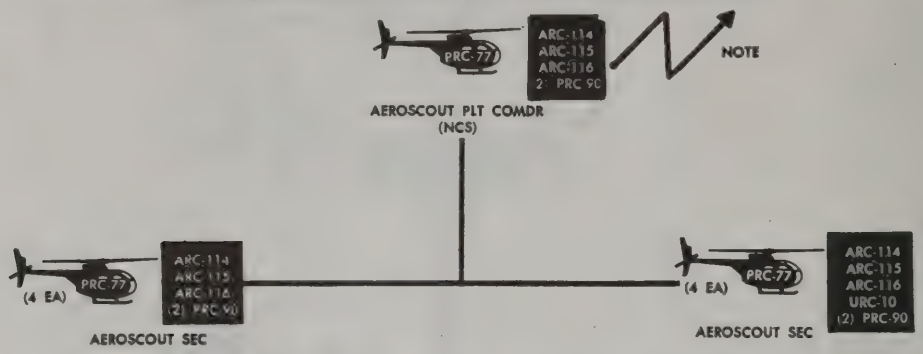


Figure A-23. Aeroscout platoon command net (FM).

TYPE RADIO COMMAND NET (UHF) DIAGRAM, AERORIFLE PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)

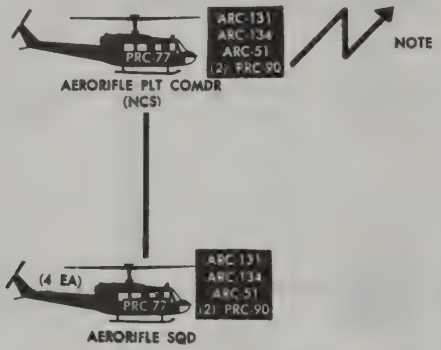
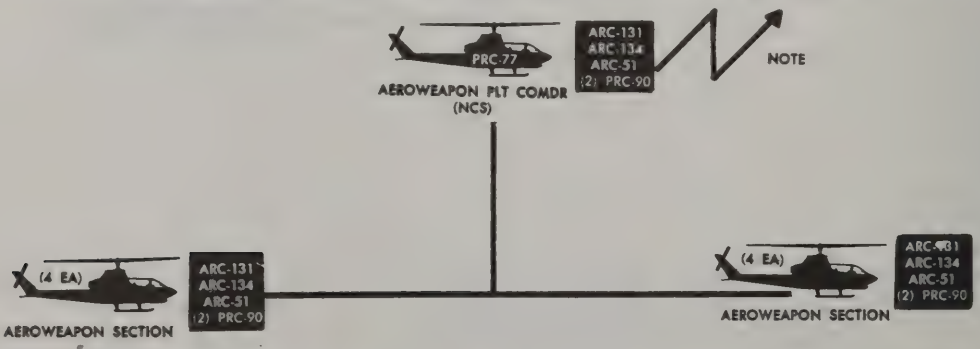


Figure A-24. Aerorifle platoon command net (FM).

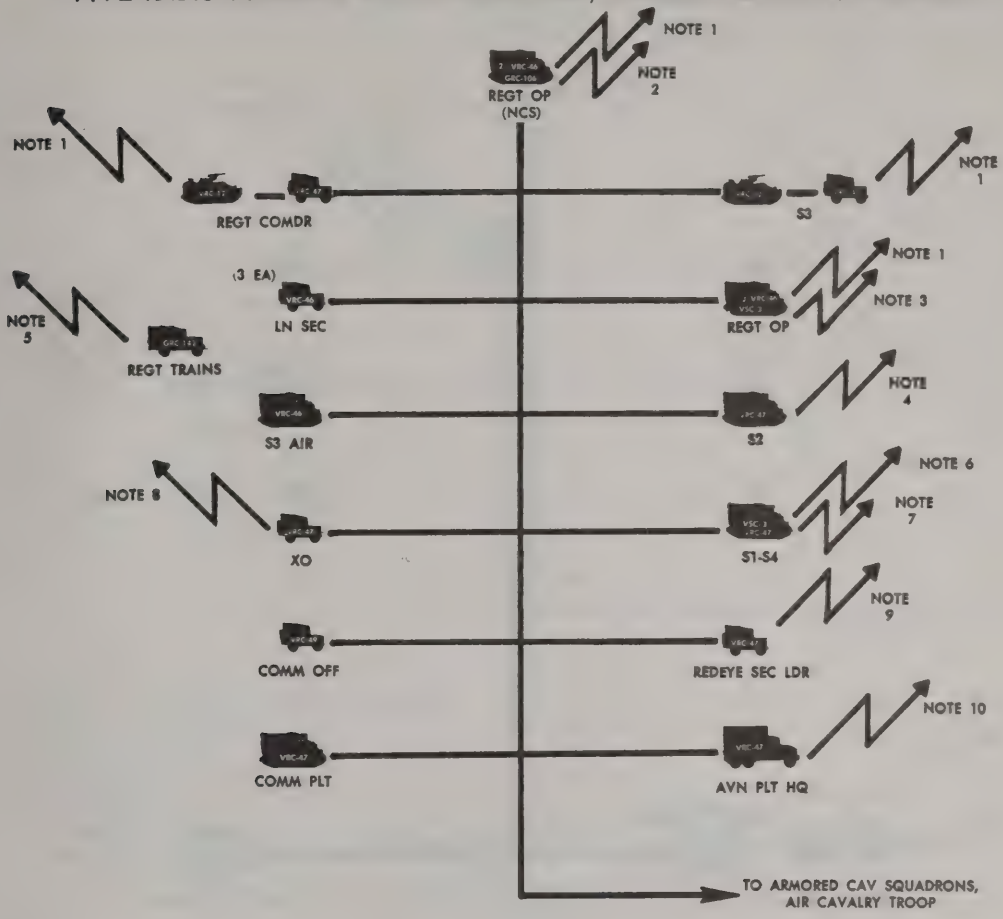
TYPE RADIO COMMAND NET (UHF) DIAGRAM, AEROWEAPONS PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISION)



Note. Operates in troop command net (FM).

Figure A-25. Aeroweapons platoon command net (FM).

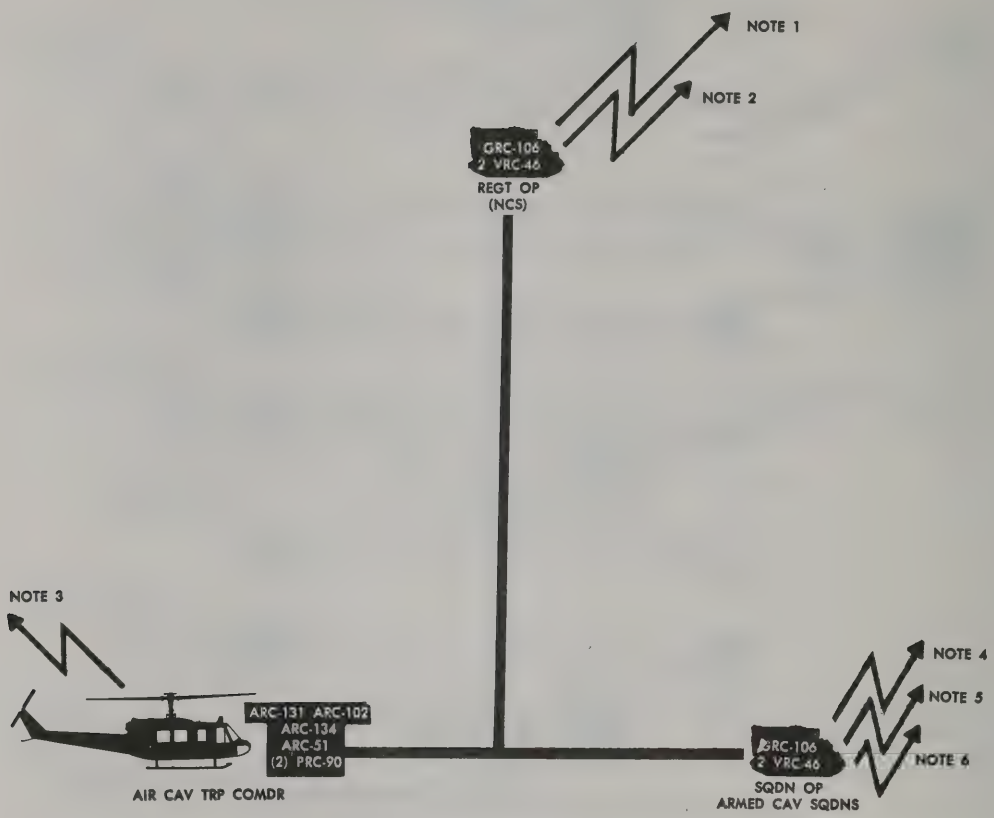
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY REGIMENT



Notes.
1. Operates in higher HQ command net (FM).
2. NCS, regt command net (AM).
3. NCS, regt op/intel net RATT (AM).
4. NCS, regt intel net (FM).
5. Operates in regt admin/log net RATT (AM); this station's equipment and personnel provided by regt common platoon.
6. NCS, regt admin/log net (FM).
7. NCS, regt admin/log net RATT (AM).
8. Operates in regt admin/log net (FM).
9. NCS, Redeye section command net (FM).
10. NCS, aviation section command net (FM).

Figure A-26. Armored cavalry regiment command net (FM).

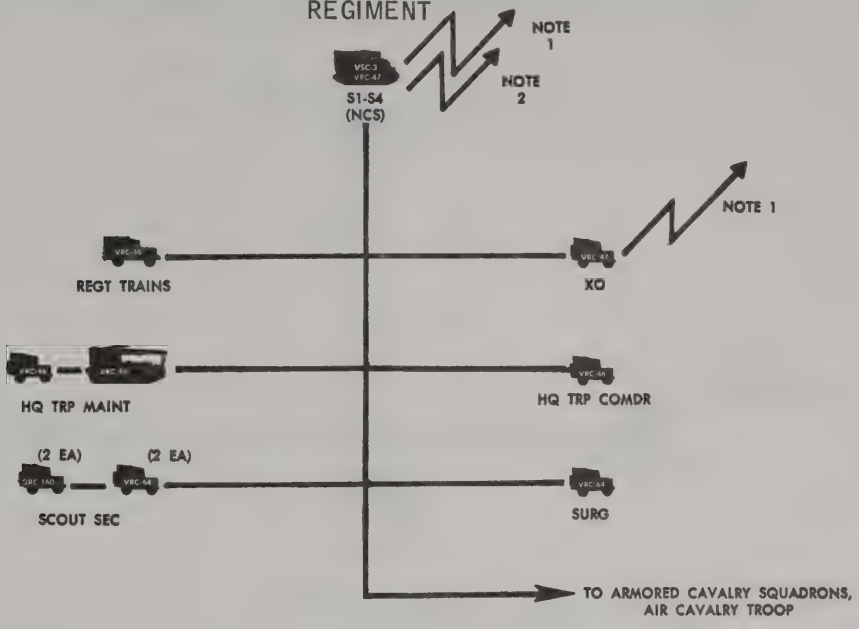
TYPE RADIO COMMAND NET (AM) DIAGRAM, ARMORED CAVALRY REGIMENT



Notes.
1. Operates in higher HQ command net (FM).
2. NCS, regt command net (FM).
3. Operates in air cav trp command net (FM).
4. Operates in regt command net (FM).
5. NCS, sqdn command net (AM).
6. NCS, sqdn command net (FM).

Figure A-27. Armored cavalry regiment command net (AM).

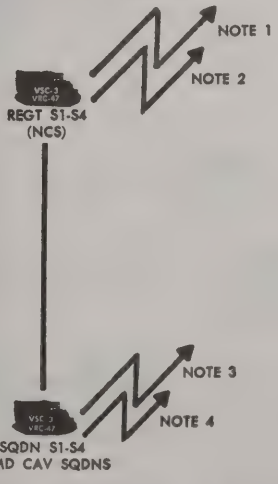
TYPE ADMINISTRATIVE/LOGISTICAL NET (FM) DIAGRAM, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. NCS, regt admin/log net RATT (AM).

Figure A-28. Armored cavalry regiment admin/log net (FM).

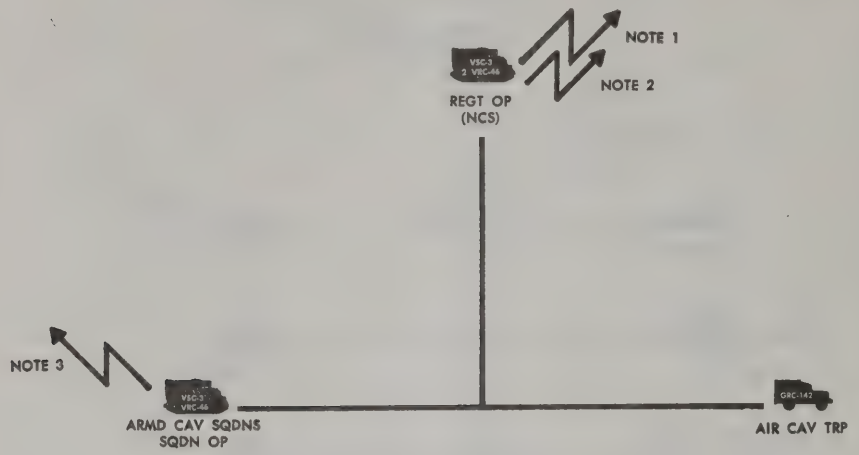
TYPE ADMINISTRATIVE/LOGISTICAL NET (RATT) DIAGRAM, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. NCS, regt admin/log net (FM).
3. Operates in regt admin/log net (FM).
4. NCS, sqdn admin/log net (FM).

Figure A-29. Armored cavalry regiment admin/log net (RATT).

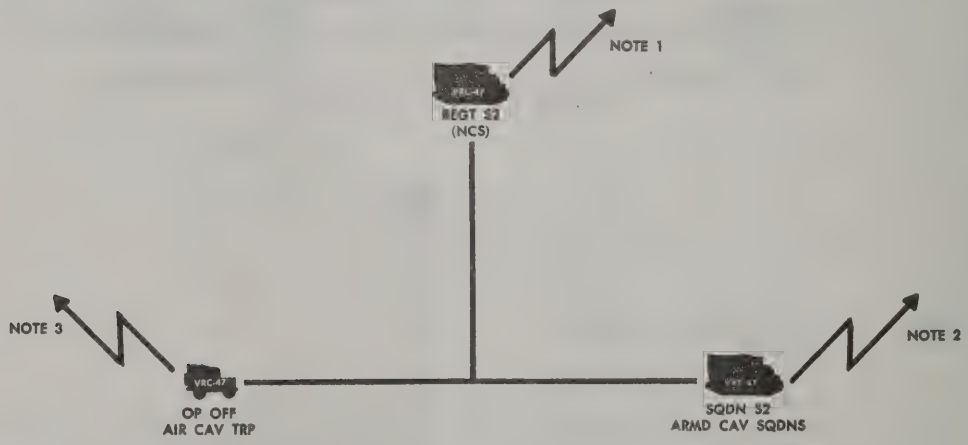
TYPE RADIO OPERATIONS/INTELLIGENCE NET (RATT) DIAGRAM,
ARMORED CAVALRY REGIMENT



Notes. 1. Operates in higher HQ command net (FM).
2. Operates in regt command net (FM).
3. Operates in sqdn command net (FM).

Figure A-30. Armored cavalry regiment operations/intelligence net (RATT).

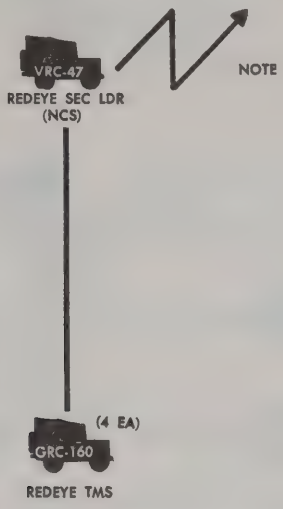
TYPE RADIO INTELLIGENCE NET (FM) DIAGRAM,
ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. Operates in sqdn command net (FM).
3. Operates in trp command net (FM).

Figure A-31. Armored cavalry regiment intelligence net (FM).

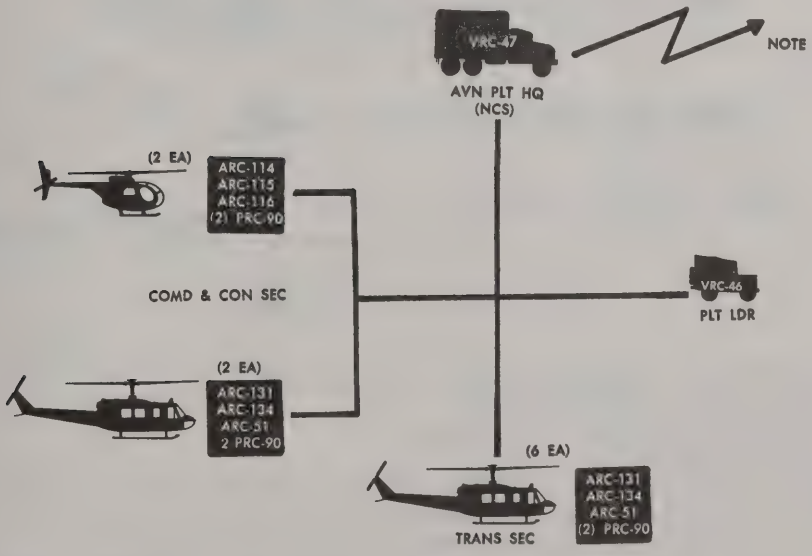
TYPE RADIO COMMAND NET (FM) DIAGRAM, REDEYE SECTION, ARMORED CAVALRY REGIMENT



Note. Operates in regt command net (FM).

Figure A-32. Redeye section command net (FM).

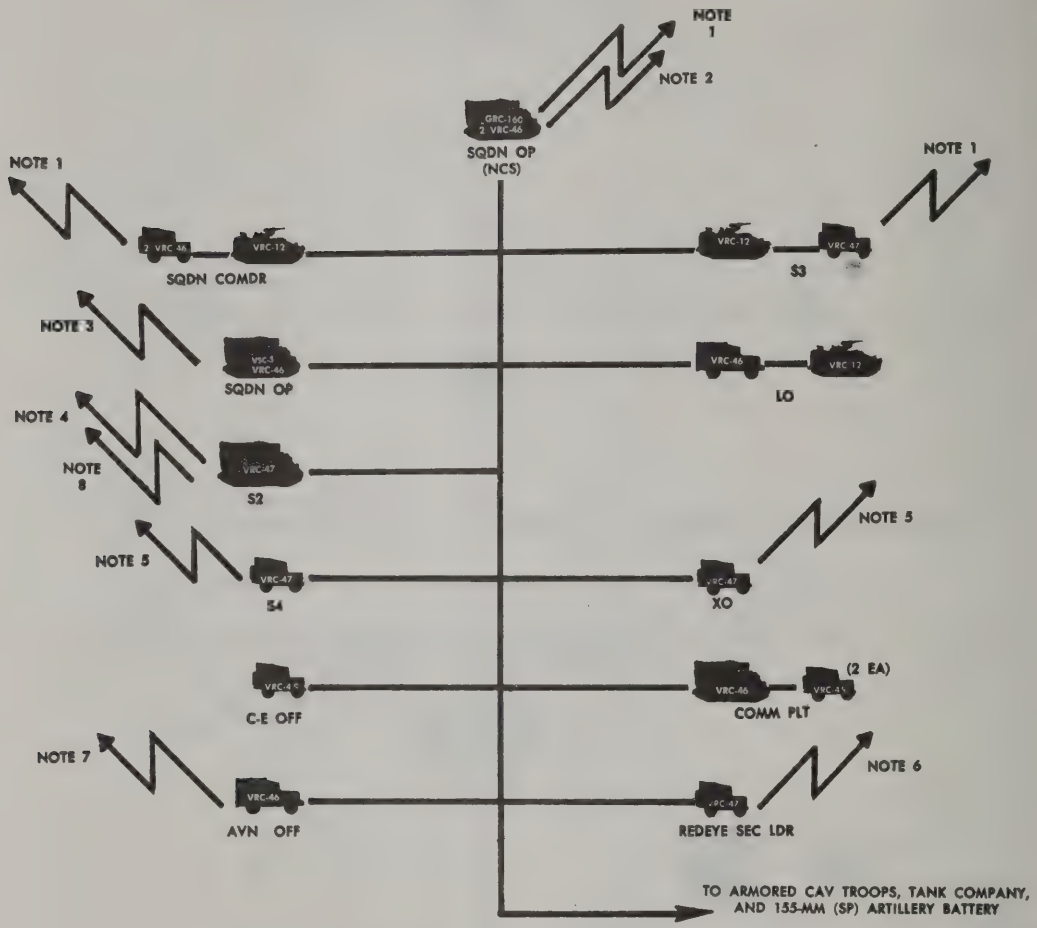
TYPE RADIO COMMAND NET (FM) DIAGRAM, AVIATION PLATOON, ARMORED CAVALRY REGIMENT



Note. Operates in regt command net (FM).

Figure A-33. Aviation platoon command net (FM).

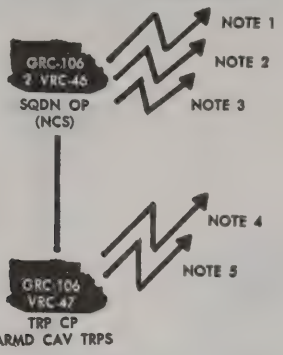
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. Operates in regt command net (AM).
3. Operates in regt op/intel net RATT (AM).
4. Operates in regt intel net (FM).
5. Operates in sqdn admin/log net (FM).
6. NCS, Redeye section command net (FM).
7. NCS, aviation section command net (FM).
8. NCS, sqdn intel net (FM).

Figure A-34. Squadron command net (FM).

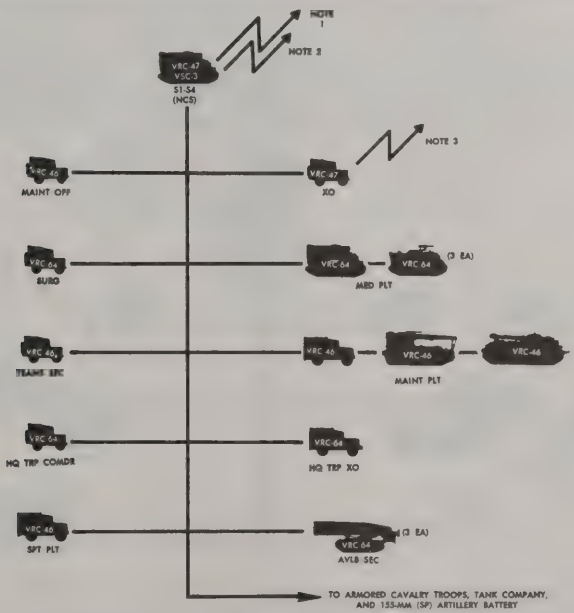
TYPE RADIO COMMAND NET (AM) DIAGRAM, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. Operates in regt command net (AM).
3. NCS, sqdn command net (FM).
4. Operates in sqdn command net (FM).
5. NCS, trp command net (FM).

Figure A-35. Squadron command net (AM).

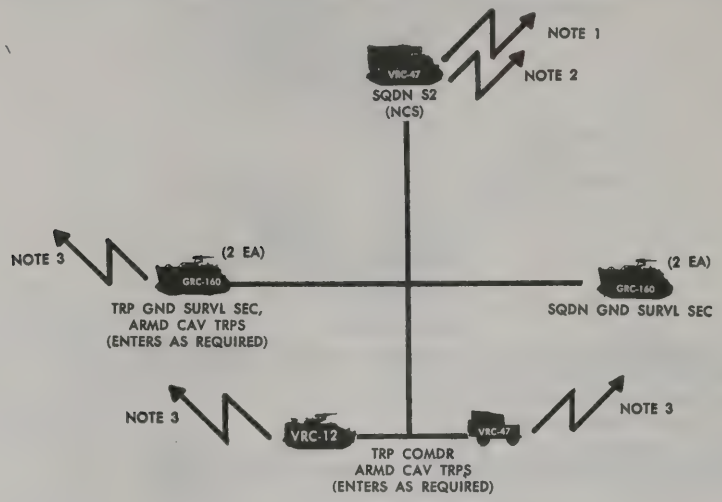
TYPE ADMINISTRATIVE/LOGISTICAL RADIO NET (FM) DIAGRAM, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt admin/log net (FM).
2. Operates in regt admin/log net RATT.
3. Operates in sqdn command net (FM).

Figure A-36. Squadron admin/log net (FM).

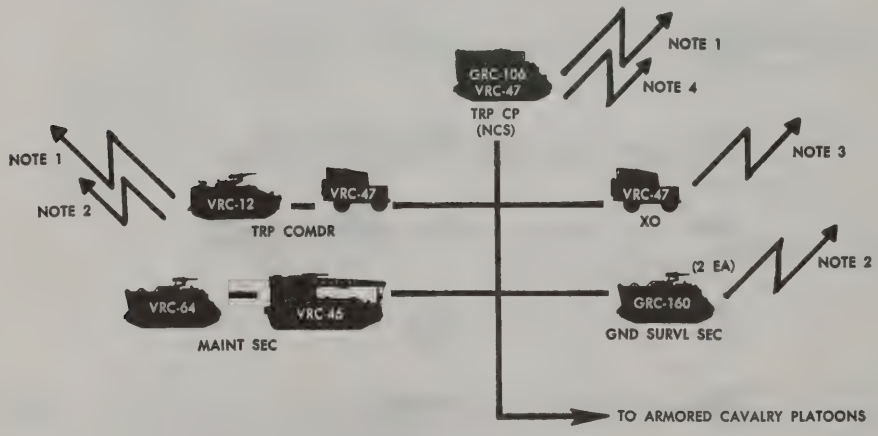
TYPE RADIO INTELLIGENCE NET (FM) DIAGRAM, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in sqdn command net (FM).
2. Operates in regt intel net (FM).
3. Operates in trp command net (FM)

Figure A-37. Squadron intelligence net (FM).

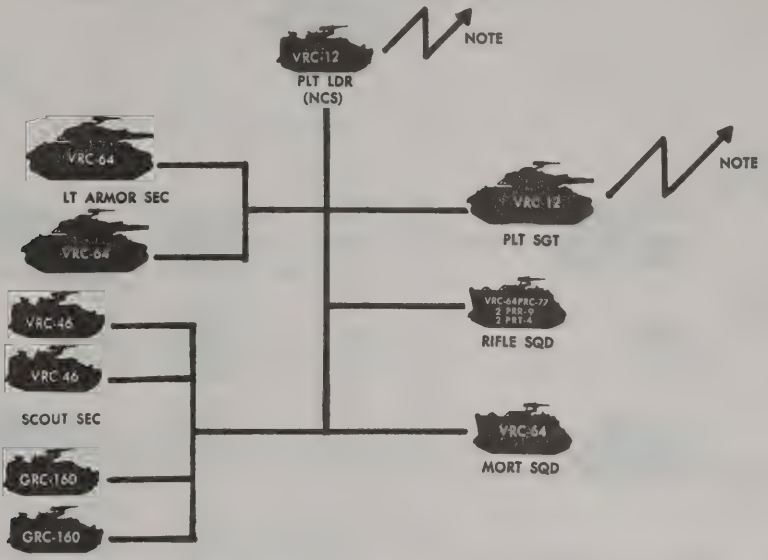
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY TROOP, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in sqdn command net (FM).
2. Enters sqdn intel net (FM) as required.
3. Operates in sqdn admin/log net (FM).
4. Operates in sqdn command net (AM).

Figure A-38. Armored cavalry troop command net (FM).

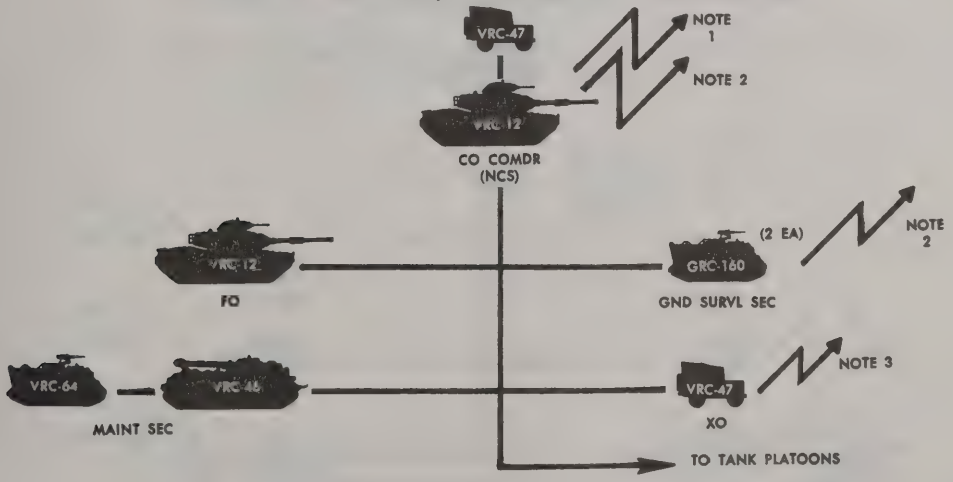
TYPE RADIO COMMAND NET (FM) DIAGRAM, ARMORED CAVALRY PLATOON, ARMORED CAVALRY TROOP, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Note. Operates in troop command net (FM).

Figure A-39. Armored cavalry platoon command net (FM).

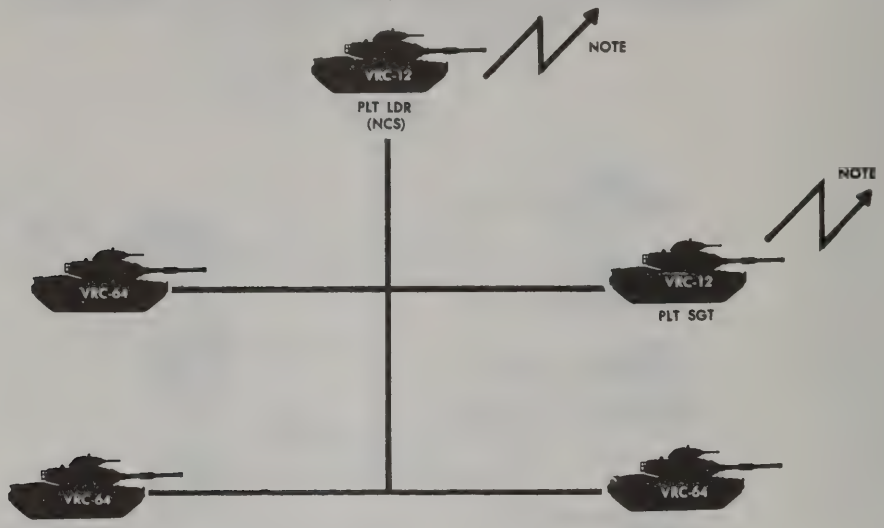
TYPE RADIO COMMAND NET (FM) DIAGRAM, TANK COMPANY, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in sqdn command net (FM).
2. Enters sqdn intel net (FM) as required.
3. Operates in sqdn admin/log net (FM).

Figure A-40. Tank company command net (FM).

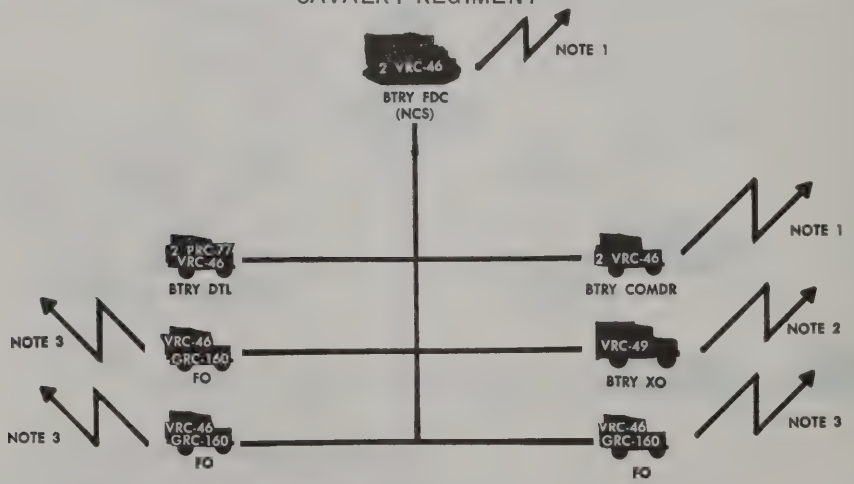
TYPE RADIO COMMAND NET (FM) DIAGRAM, TANK PLATOON, TANK COMPANY, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Note. Operates in company command net (FM).

Figure A-41. Tank platoon command net (FM).

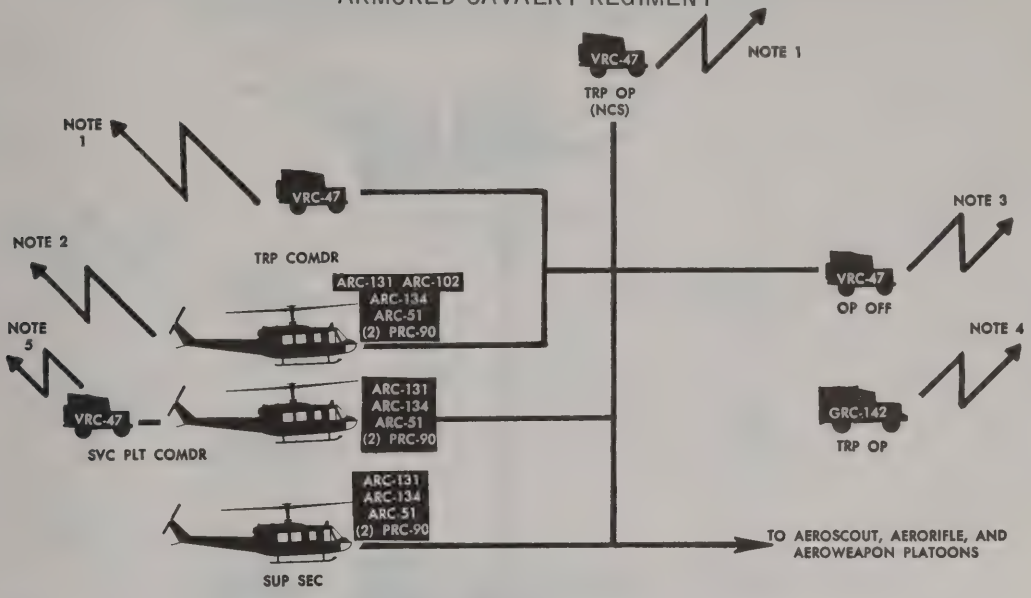
TYPE RADIO COMMAND/FD NET (FM) DIAGRAM, FIELD ARTILLERY BATTERY, 155-MM SELF-PROPELLED, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in sqdn command net (FM).
2. Operates in sqdn admin/log net (FM).
3. FM link to supported unit.

Figure A-42. Howitzer battery command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, AIR CAVALRY TROOP, ARMORED CAVALRY REGIMENT



Notes. 1. Operates in regt command net (FM).
2. Operates in regt command net (AM).
3. Operates in regt intel net (FM).
4. Operates in regt op/intel net RATT.
5. Operates in regt admin/log net (FM).

Figure A-43. Air cavalry troop command net (FM).

TYPE RADIO COMMAND NET (UHF) DIAGRAM, AEROSCOUT PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY REGIMENT

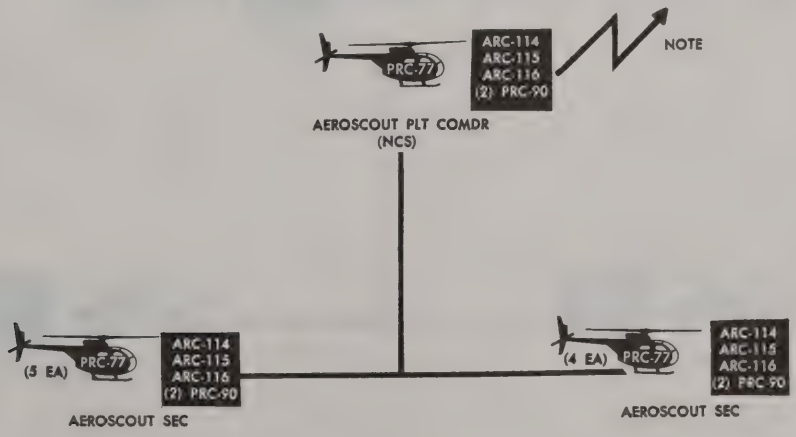


Figure A-44. Aeroscout platoon command net (FM).

TYPE RADIO COMMAND NET (UHF) DIAGRAM, AERORIFLE PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY REGIMENT

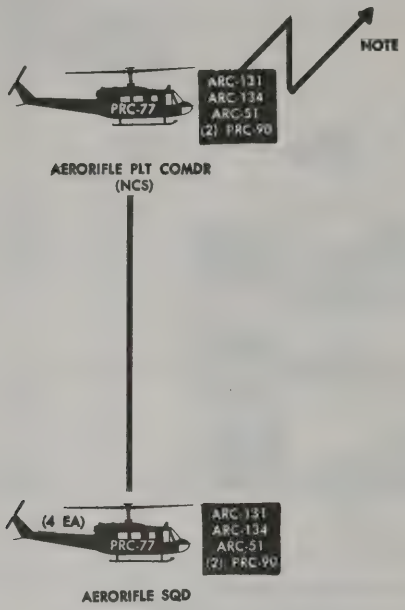
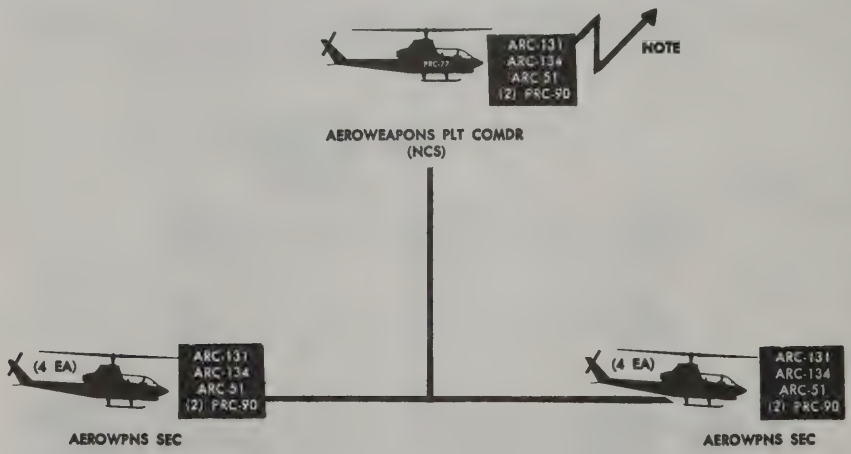


Figure A-45. Aerorifle platoon command net (FM).

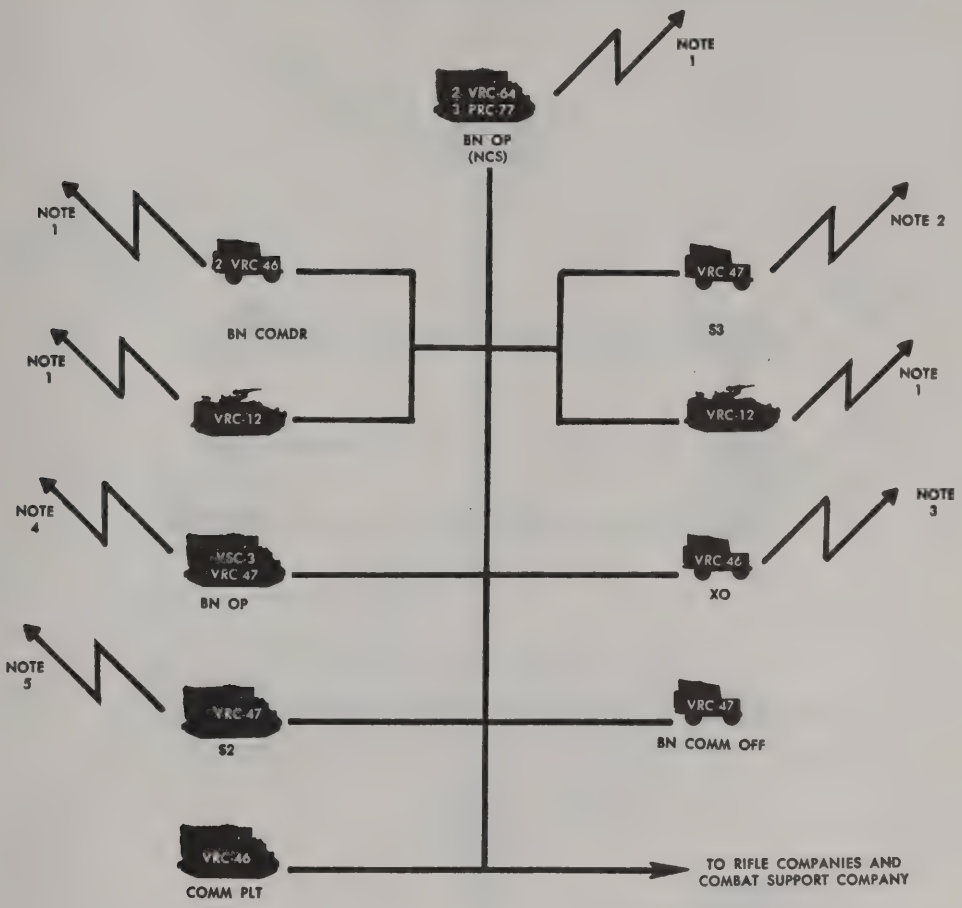
TYPE RADIO COMMAND NET (UHF) DIAGRAM, AEROWEAPONS PLATOON, AIR CAVALRY TROOP, ARMORED CAVALRY REGIMENT



Note. Operates in troop command net (FM).

Figure A-46. Aeroweapons platoon command net (FM).

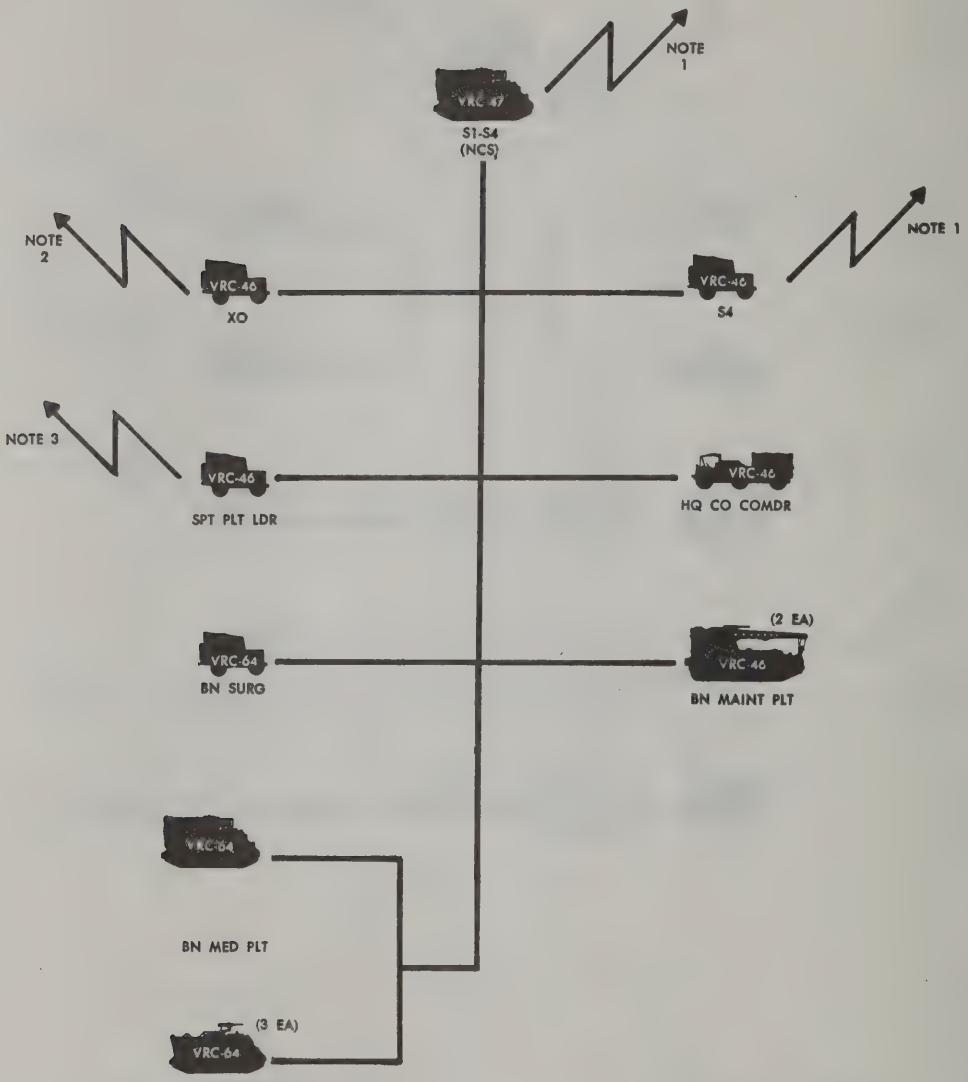
TYPE RADIO COMMAND NET (FM) DIAGRAM, INFANTRY BATTALION (MECHANIZED)



Notes. 1. Operates in bde command net (FM).
2. Monitors bde command net (FM).
3. Operates in bn admin/log net (FM).
4. Operates in bde RATT net.
5. Monitors bn gnd survl net (FM).

Figure A-47. Infantry battalion (mech) command net (FM).

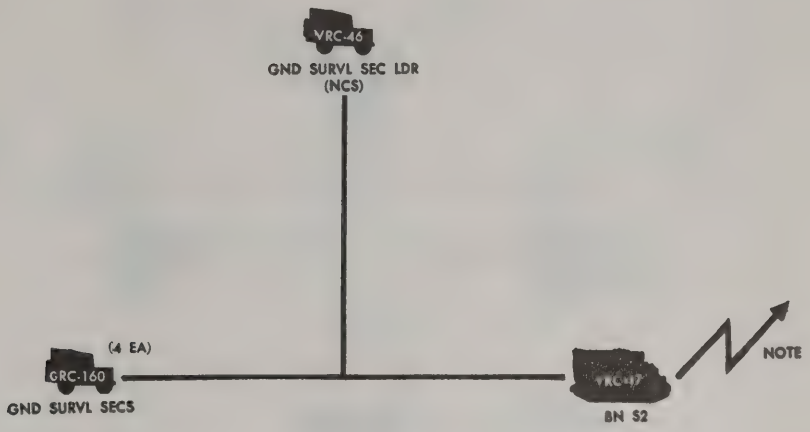
TYPE RADIO ADMINISTRATIVE/LOGISTICAL NET (FM) DIAGRAM,
INFANTRY BATTALION (MECHANIZED)



Notes. 1. Monitors bn command net (FM).
2. Operates in bn command net (FM).
3. Enters bde admin/log net (FM) as required.

Figure A-48. Infantry battalion (mech) admin/log net (FM).

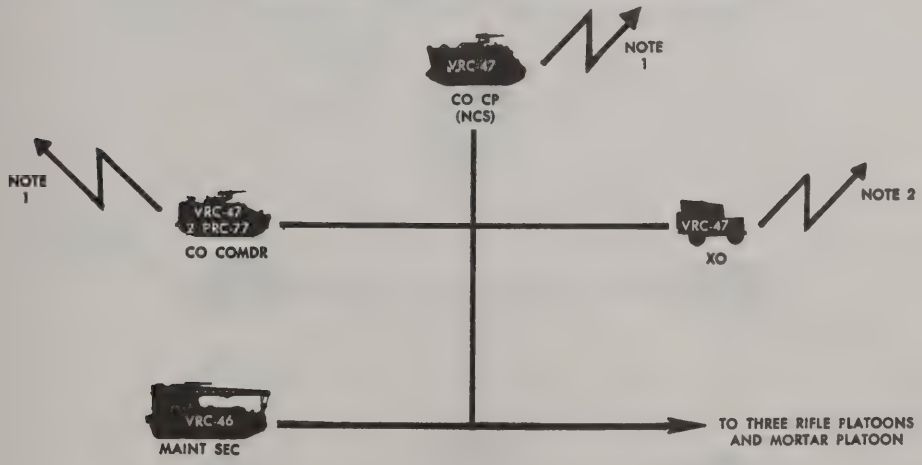
TYPE RADIO GROUND SURVEILLANCE NET (FM) DIAGRAM,
INFANTRY BATTALION (MECHANIZED)



Note. Operates in bn command net (FM).

Figure A-49. Surveillance net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, RIFLE COMPANY
INFANTRY BATTALION (MECHANIZED)



Notes. 1. Monitors bn command net (FM).
2. Monitors bn admin/log net (FM).

Figure A-50. Rifle company command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, RIFLE PLATOON, RIFLE COMPANY (MECHANIZED), INFANTRY BATTALION (MECHANIZED)

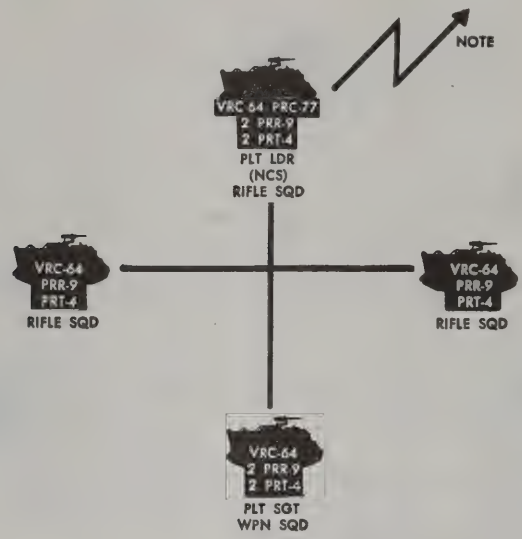
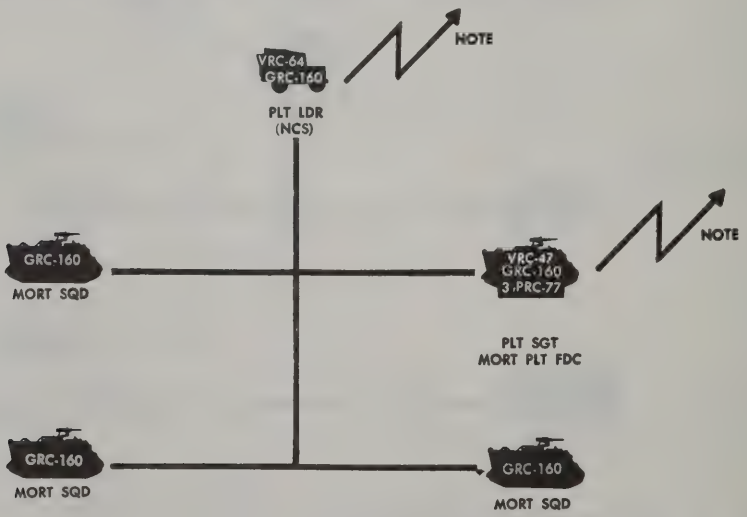


Figure A-51. Rifle platoon command net (FM).

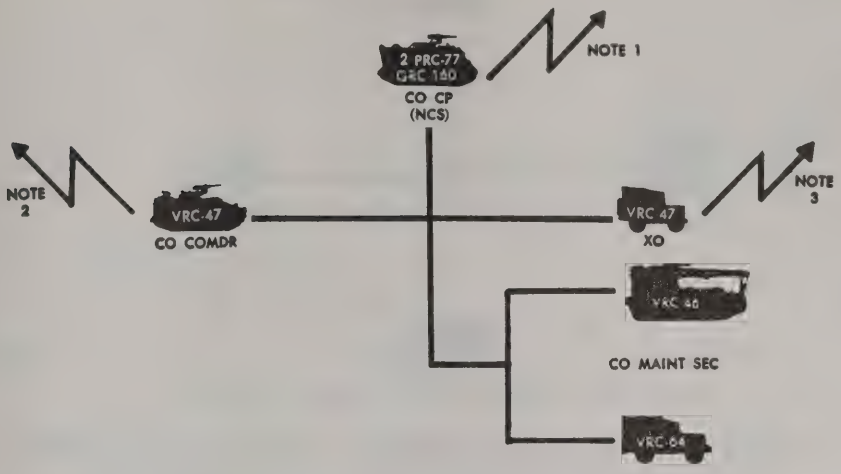
TYPE RADIO COMMAND NET (FM) DIAGRAM, MORTAR PLATOON, RIFLE COMPANY (MECHANIZED), INFANTRY BATTALION (MECHANIZED)



Note. Operates in company command net (FM).

Figure A-52. Mortar platoon command net (FM).

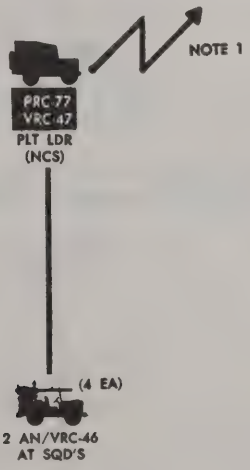
TYPE RADIO COMMAND NET (FM) DIAGRAM, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECHANIZED)



Notes. 1. Operates in bn command net (FM).
2. Monitors bn command net (FM).
3. Monitors bn admin/log net (FM).

Figure A-53. Combat support company command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, ANTITANK PLATOON, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECHANIZED)



Notes. 1. Operates in the bn command net (FM).
2. Operates in arty bn comd/FD net (FM).

Figure A-54. Antitank platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, MORTAR PLATOON, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECHANIZED)

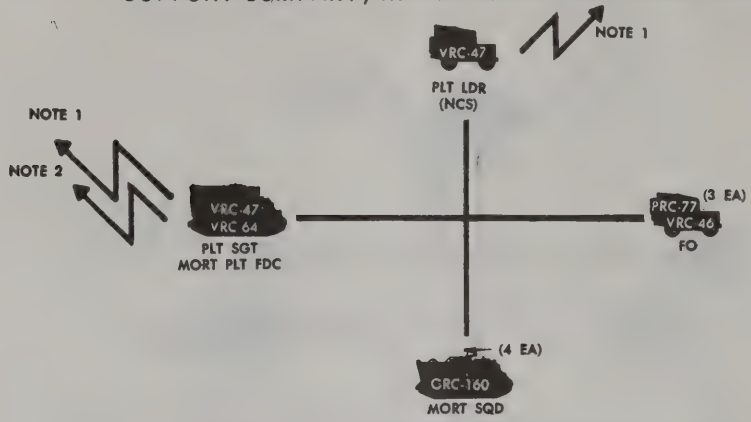


Figure A-55. Mortar platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, SCOUT PLATOON, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECHANIZED)

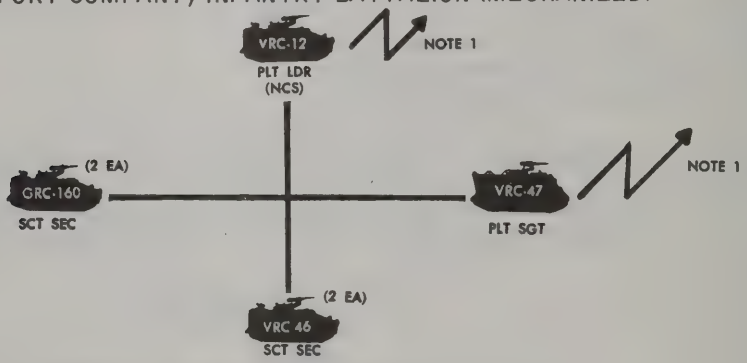


Figure A-56. Scout platoon command net (FM).

TYPE RADIO COMMAND NET (FM) DIAGRAM, REDEYE SECTION, COMBAT SUPPORT COMPANY, INFANTRY BATTALION (MECHANIZED)

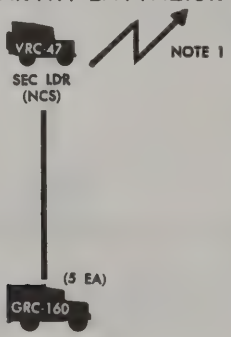
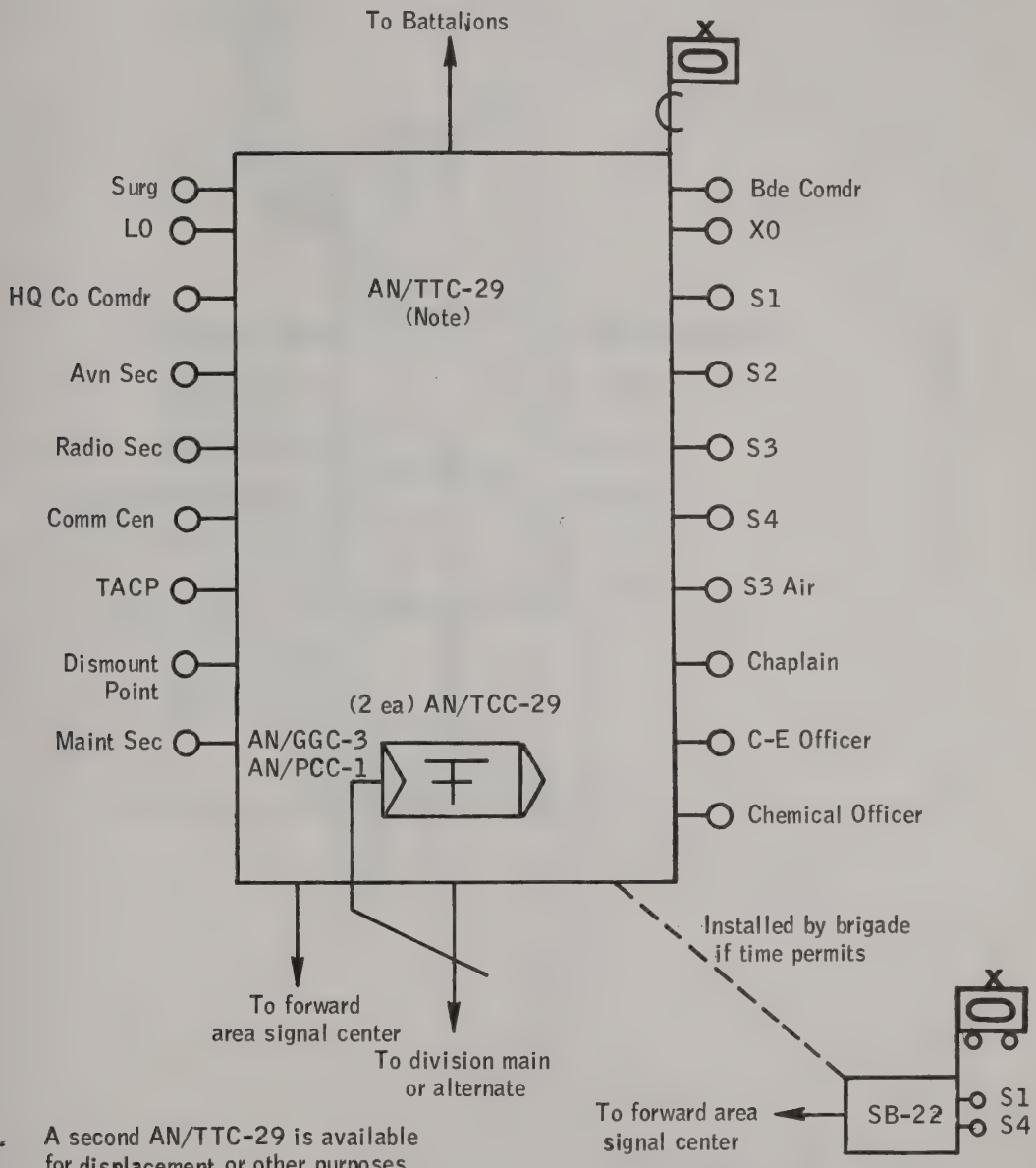


Figure A-57. Redeye section command net (FM).

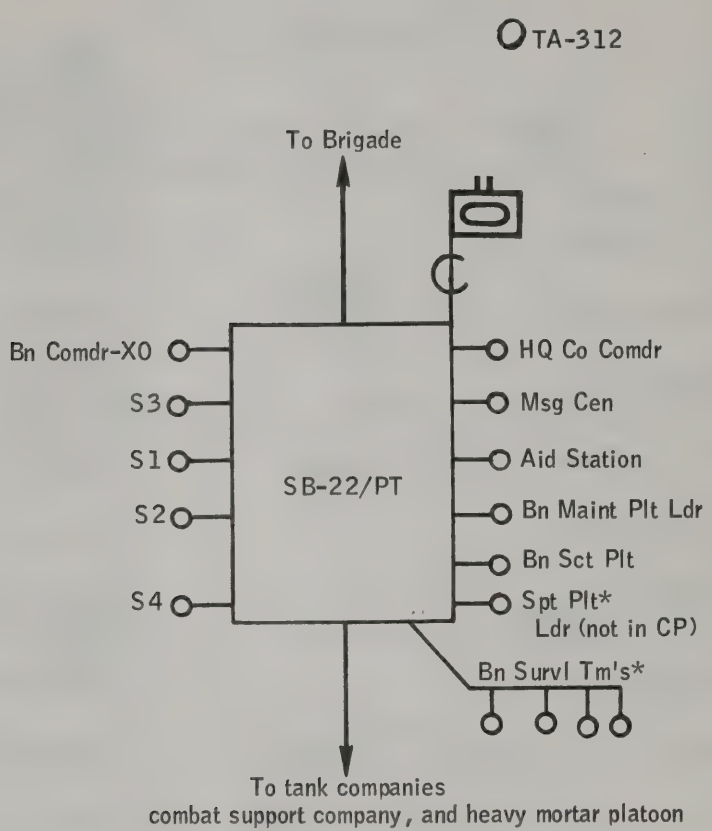
TYPE WIRE NET DIAGRAM, ARMORED BRIGADE, HEADQUARTERS AND HEADQUARTERS COMPANY



Note. A second AN/TTC-29 is available for displacement or other purposes.

Figure A-58. Brigade wire net diagram.

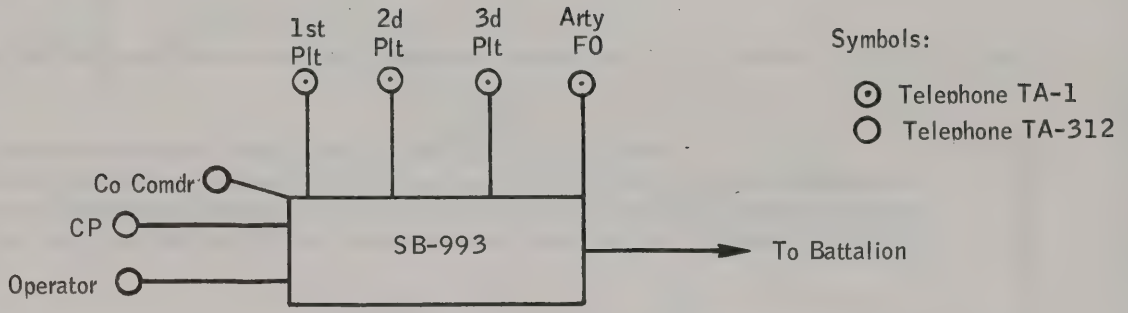
TYPE WIRE NET DIAGRAM, HEADQUARTERS AND HEADQUARTERS COMPANY, TANK BATTALION



*These TA-312's provided by the combat support company.

Figure A-59. Headquarters and headquarters company tank battalion wire net diagram.

TYPE WIRE NET DIAGRAM, TANK COMPANY, TANK BATTALION



Notes. 1. Installed, maintained, and operated under supervision of the company communication chief. The switchboard is normally located in the company CP.
2. There is one spare TA-312 in the HQ section.

Figure A-60. Tank company wire net diagram.

TYPE WIRE NET DIAGRAM, TANK PLATOON, TANK COMPANY, TANK BATTALION

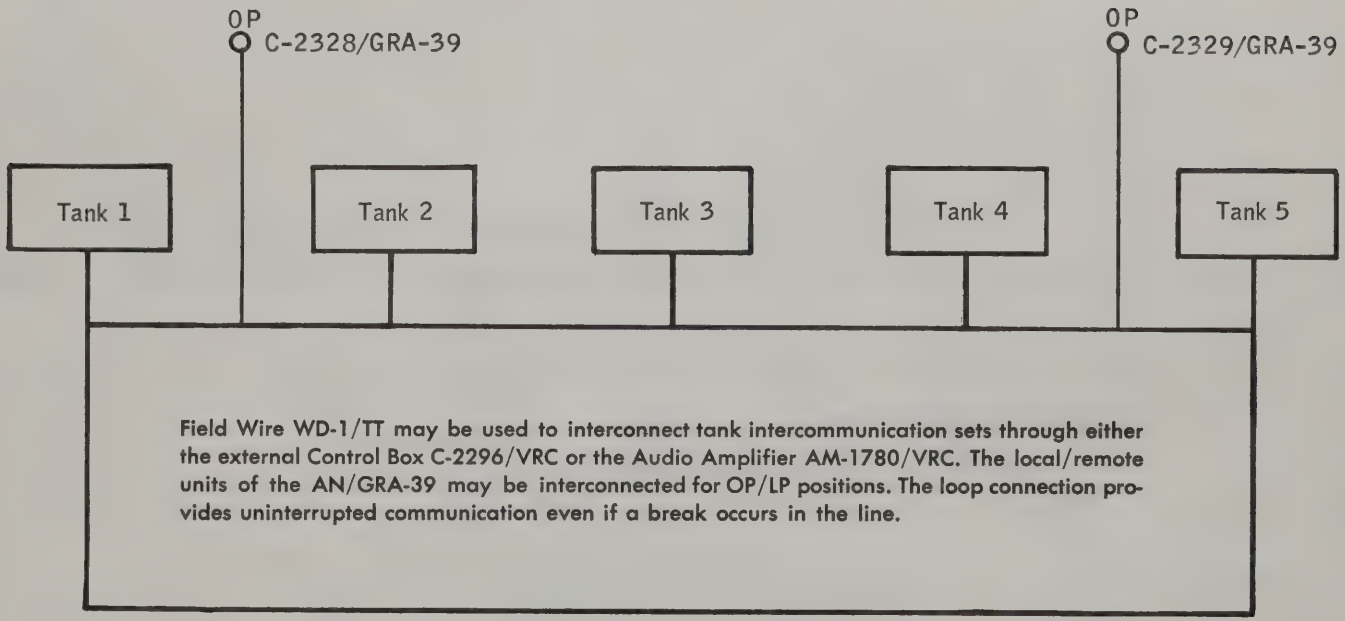

OP
C-2328/GRA-39
OP
C-2329/GRA-39
Tank 1
Tank 2
Tank 3
Tank 4
Tank 5
Field Wire WD-1/TT may be used to interconnect tank intercommunication sets through either the external Control Box C-2296/VRC or the Audio Amplifier AM-1780/VRC. The local/remote units of the AN/GRA-39 may be interconnected for OP/LP positions. The loop connection provides uninterrupted communication even if a break occurs in the line.

Figure A-61. Tank platoon wire net diagram.

TYPE WIRE NET DIAGRAM, TANK BATTALION, COMBAT SUPPORT COMPANY

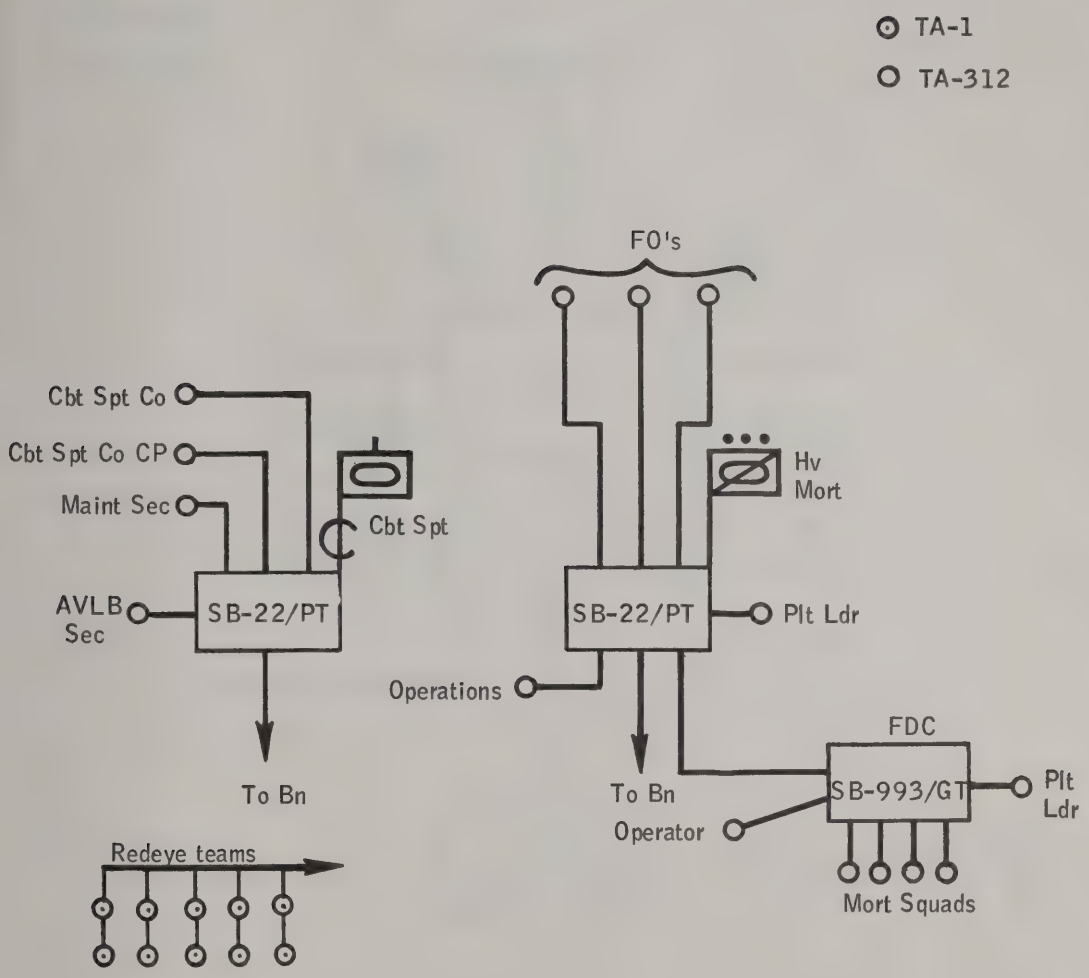


Figure A-62. Combat support company wire net diagram.

TYPE WIRE NET DIAGRAM, ARMORED CAVALRY SQUADRON (DIVISIONAL), HEADQUARTERS AND HEADQUARTERS TROOP

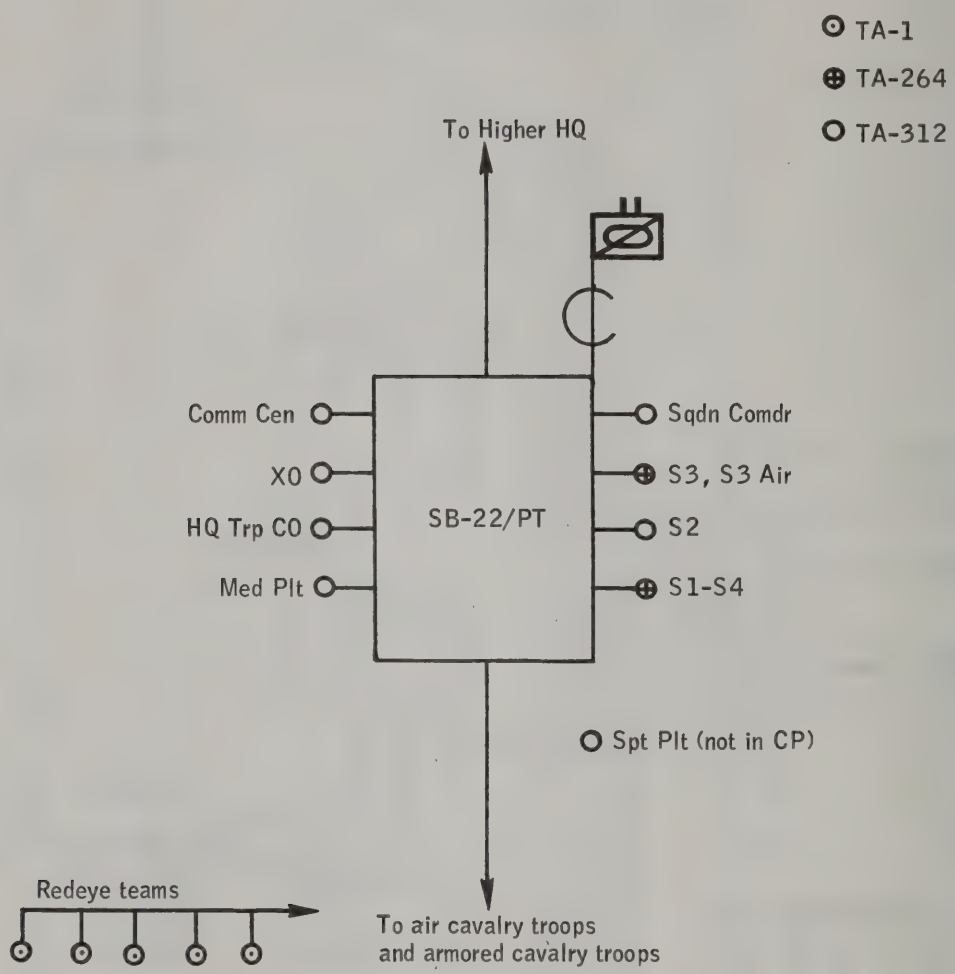


Figure A-63. Headquarters and headquarters troop, armored cavalry squadron wire net diagram.

TYPE WIRE NET DIAGRAM, AIR CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISIONAL)

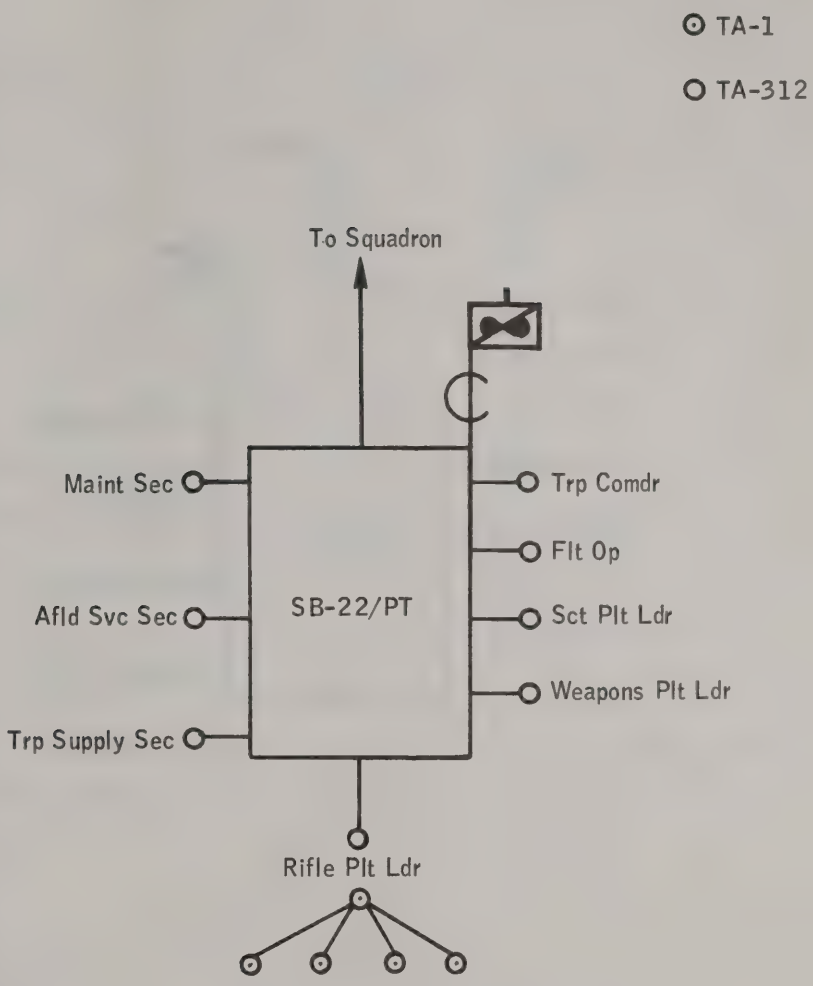


Figure A-64. Air cavalry troop wire net diagram.

TYPE WIRE NET DIAGRAM, ARMORED CAVALRY TROOP, ARMORED CAVALRY SQUADRON (DIVISIONAL)

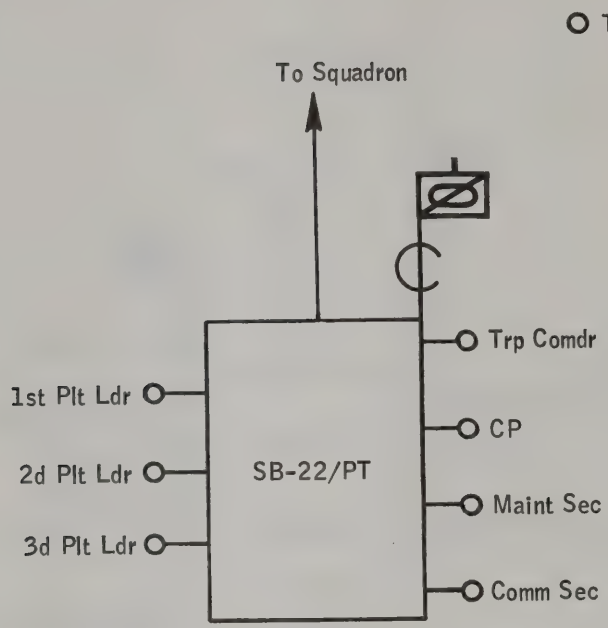


Figure A-65. Armored cavalry troop wire net diagram.

TYPE WIRE NET DIAGRAM, HEADQUARTERS AND HEADQUARTERS TROOP, ARMORED CAVALRY REGIMENT

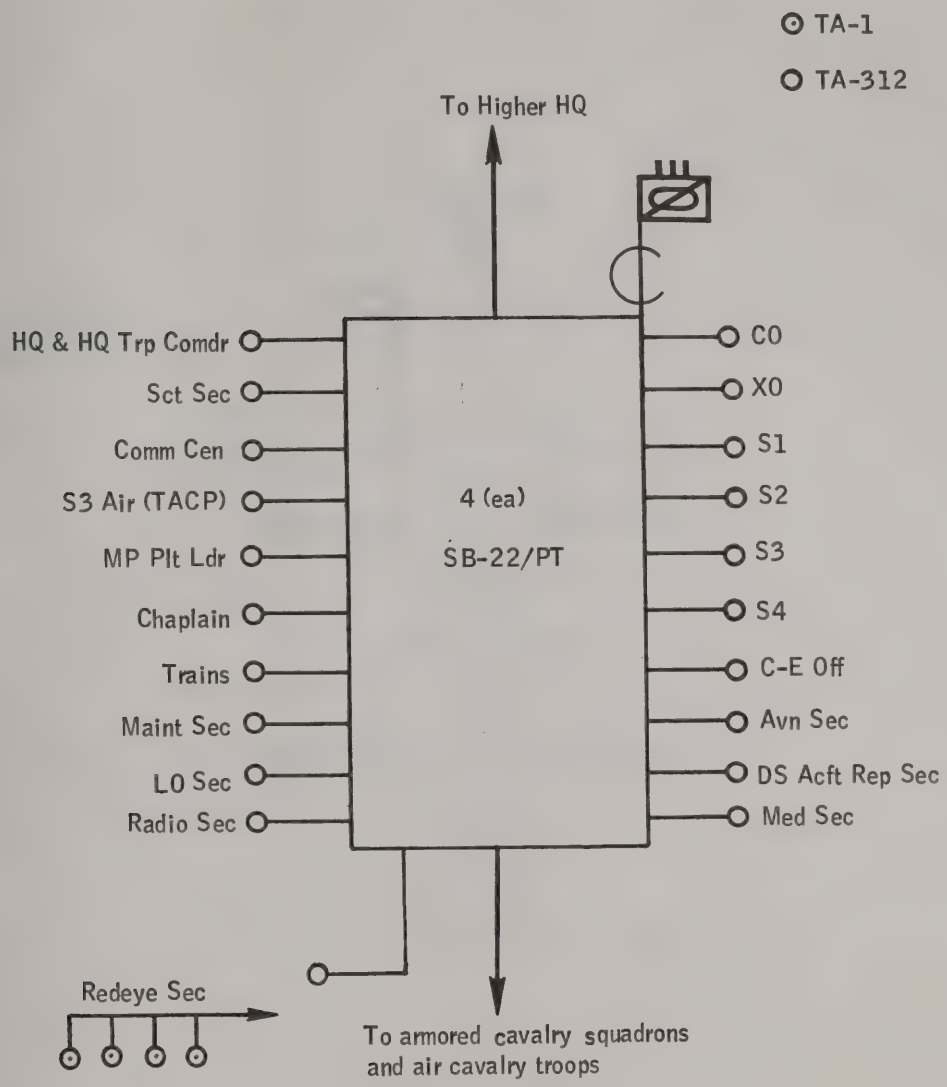


Figure A-66. Headquarters and headquarters troop, armored cavalry regiment wire net diagram.

TYPE WIRE NET DIAGRAM, AIR CAVALRY TROOP, ARMORED CAVALRY REGIMENT

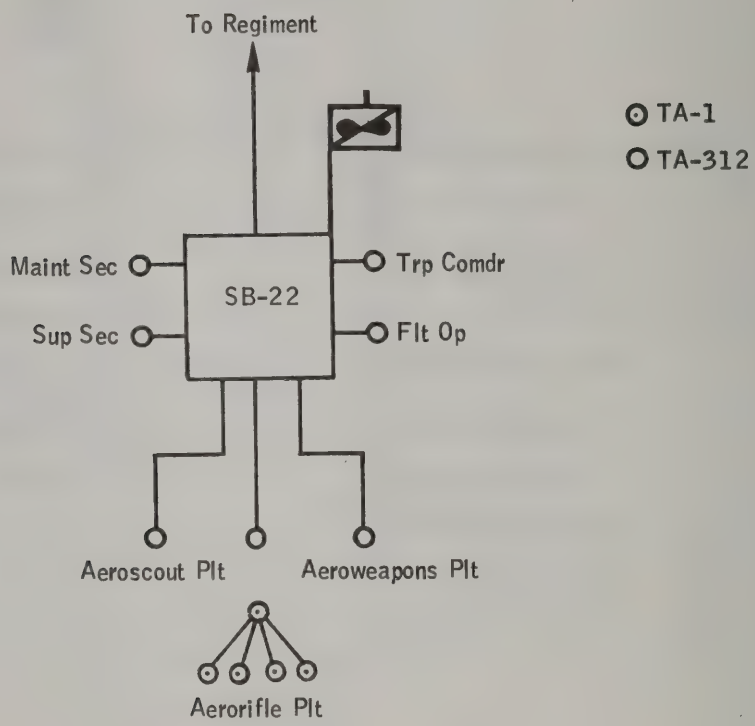


Figure A-67. Air cavalry troop wire net diagram.

TYPE WIRE NET DIAGRAM, HEADQUARTERS AND HEADQUARTERS TROOP, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT

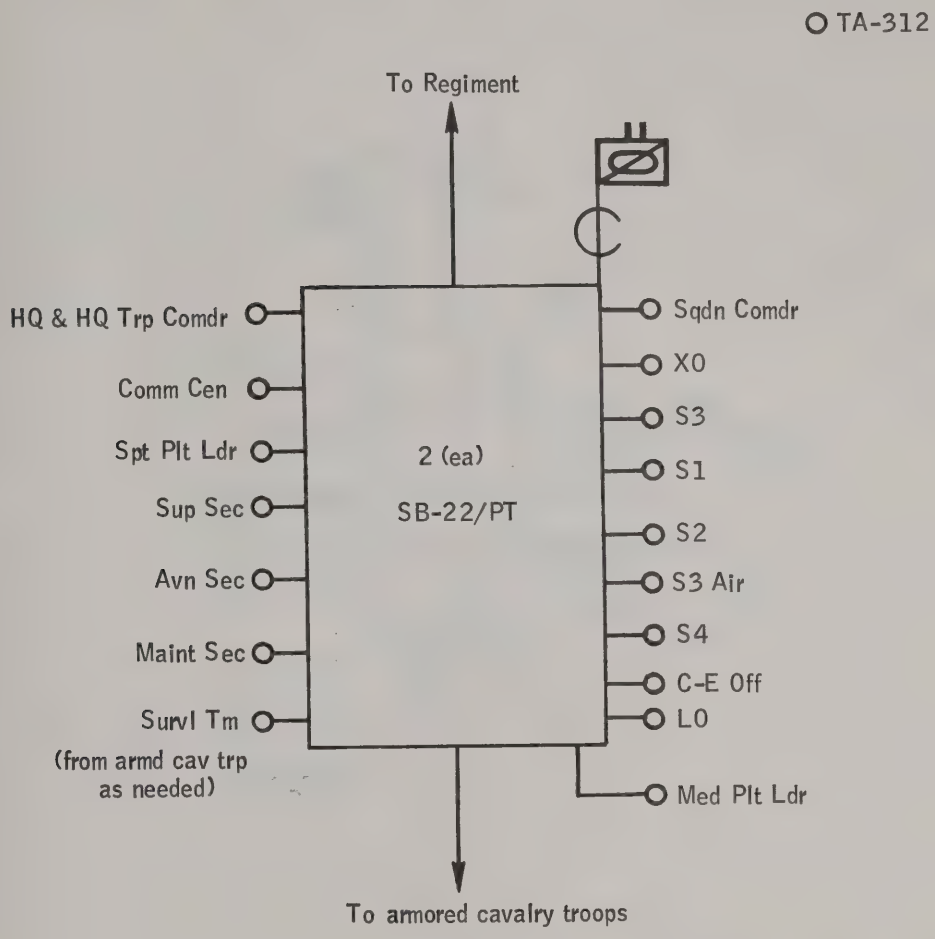


Figure A-68. Headquarters and headquarters troop, armored cavalry (regt) wire net diagram.

TYPE WIRE NET DIAGRAM, ARMORED CAVALRY TROOP,
ARMORED CAVALRY REGIMENT

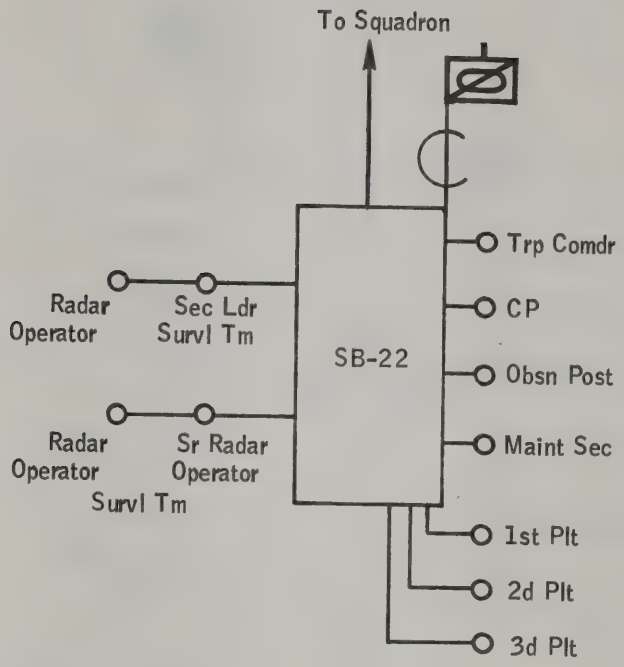


Figure A-69. Armored cavalry troop wire net diagram.

TYPE WIRE NET DIAGRAM, TANK COMPANY, ARMORED CAVALRY REGIMENT

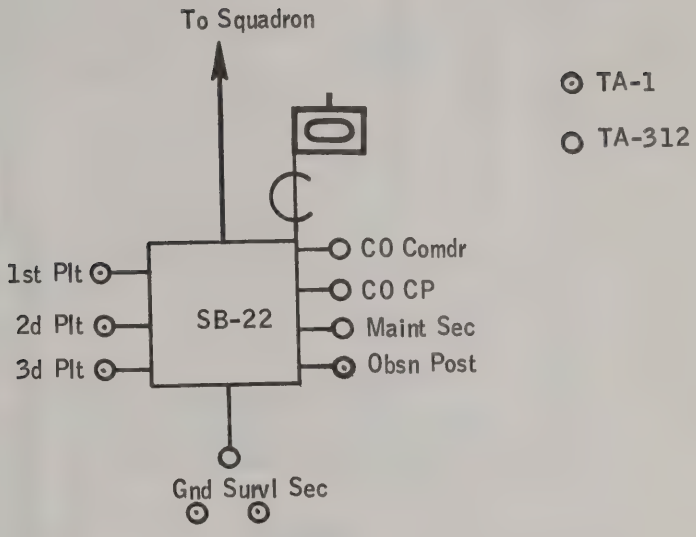
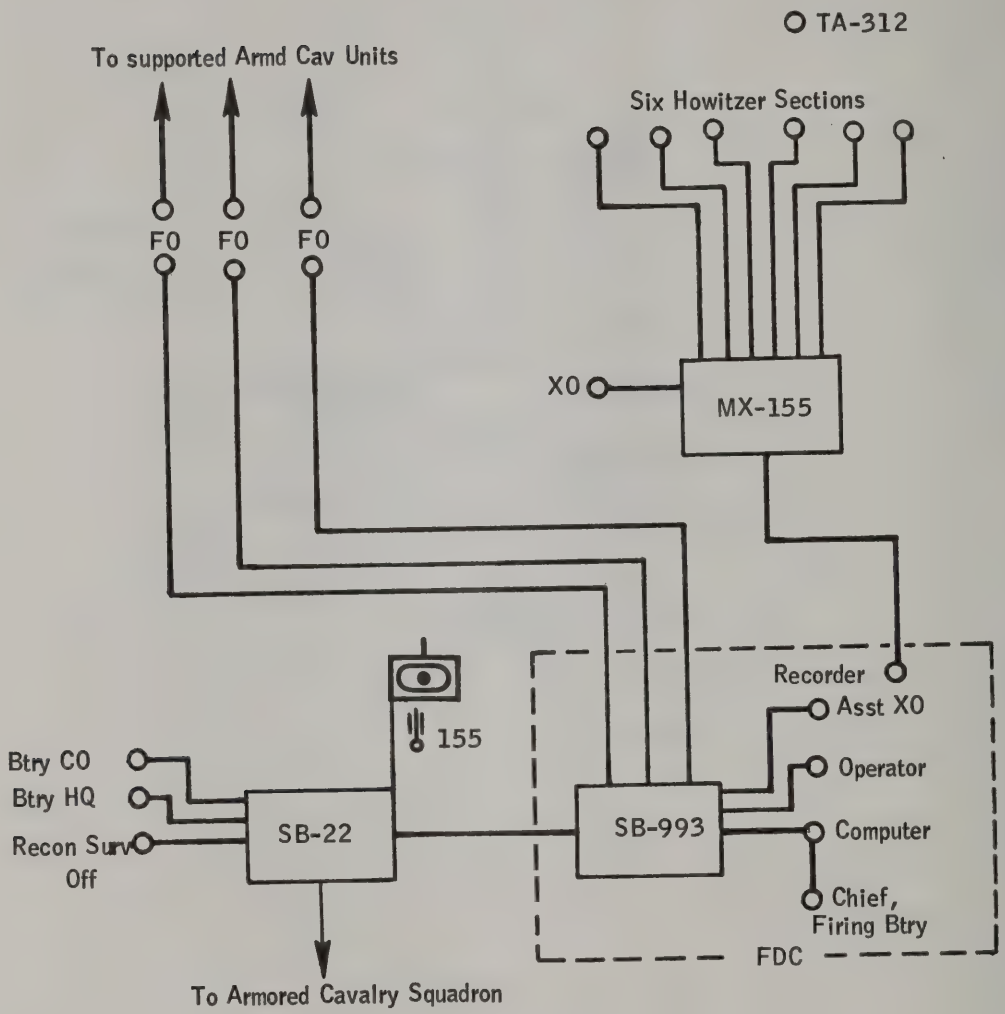


Figure A-70. Tank company wire net diagram.

TYPE WIRE NET DIAGRAM, FIELD ARTILLERY BATTERY, 155-MM, SELF-PROPELLED, ARMORED CAVALRY SQUADRON, ARMORED CAVALRY REGIMENT



Note. Also authorized an additional three TA-312's; may be used as required.

Figure A-71. Howitzer battery wire net.

TYPE WIRE NET DIAGRAM, HEADQUARTERS AND HEADQUARTERS COMPANY, INFANTRY BATTALION (MECHANIZED)

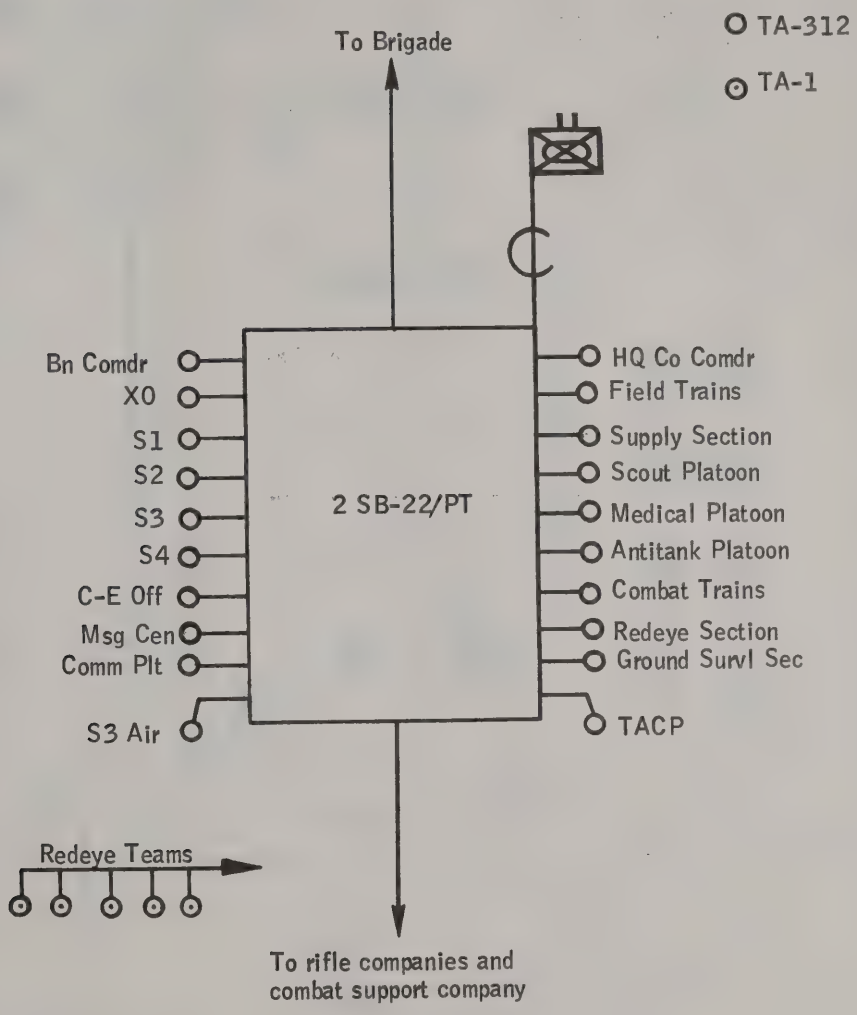


Figure A-72. Headquarters and headquarters company, infantry battalion wire net diagram.

TYPE WIRE NET DIAGRAM, RIFLE COMPANY, INFANTRY BATTALION (MECHANIZED)

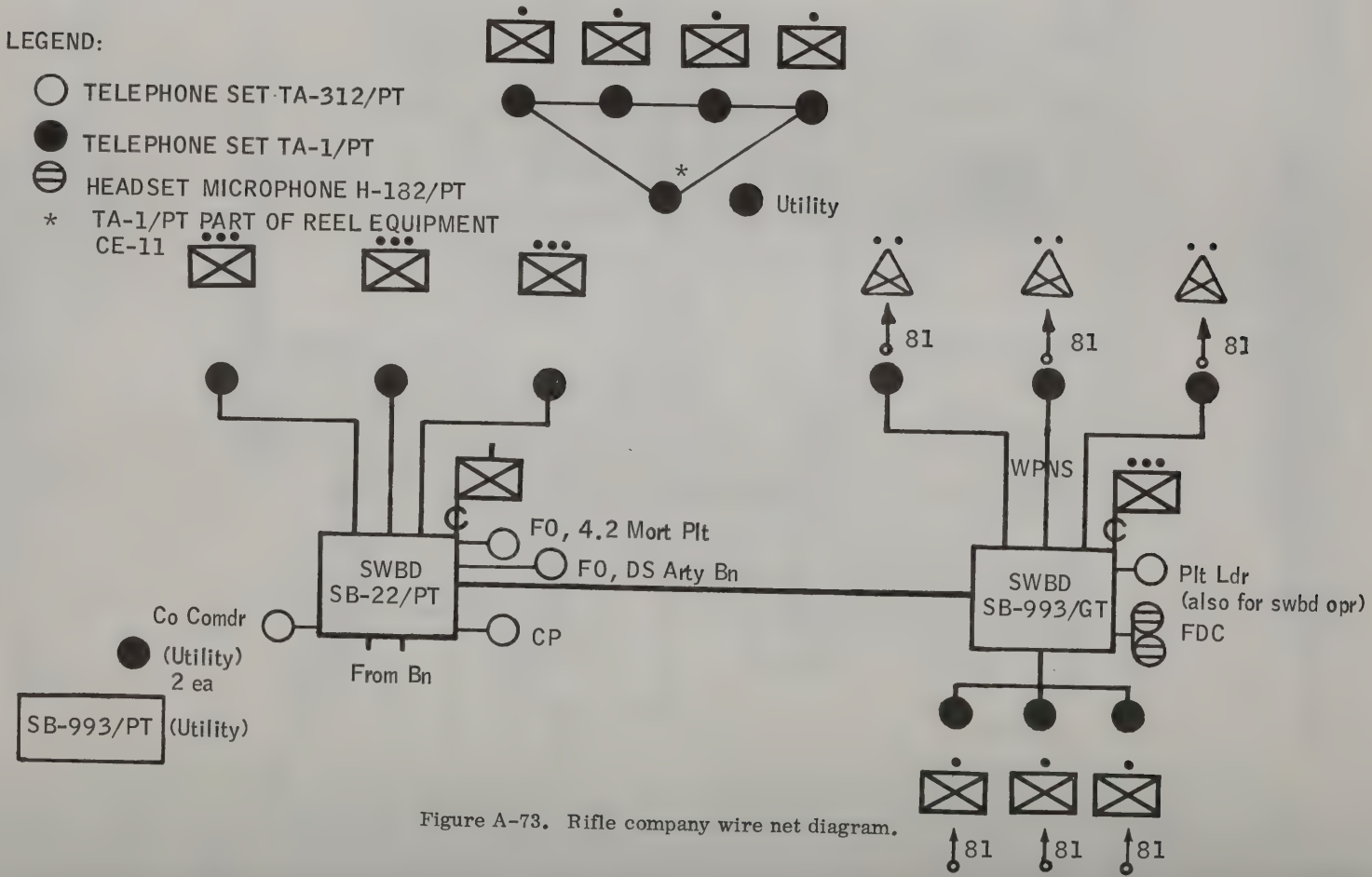


Figure A-73. Rifle company wire net diagram.

TYPE WIRE NET DIAGRAM, COMBAT SUPPORT COMPANY,
INFANTRY BATTALION (MECHANIZED)

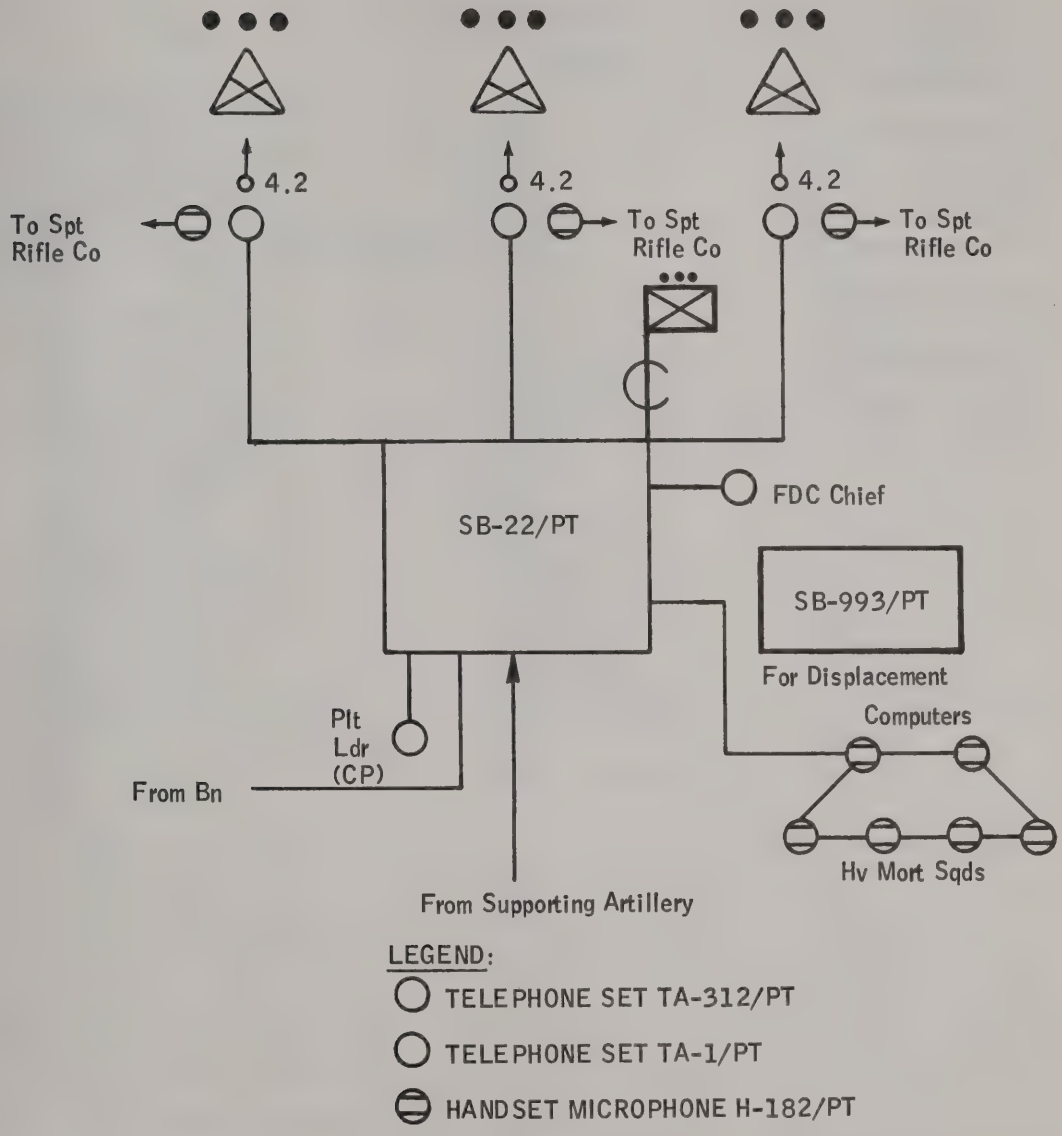


Figure A-74. Combat support company wire net diagram.

APPENDIX B

ARMOR UNIT'S COMMUNICATIONS-ELECTRONICS EQUIPMENT

(Hotel Series TOE's)

Charts

Unit	Chart No.
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Note. Charts are in back of book.

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*U.S. GOVERNMENT PRINTING OFFICE: 1976-657-693/6018

ALION (TOE 11-35H)

COMPANY		SIGNAL SUPPORT OPERATIONS COMPANY																
Multichannel Comm Sec (3)	Fwd Comm Co Total	Co Hq	Fld Cable Instl Plt Hq	Cable Instl Tm's (8)	Multichannel Comm Ratt Sec	Rear Ech Op Plt Hq	Radio Tty Tm	Comm Cen Sec	Spt-Comm Op Plt Hq	Multichannel Comm Tml Sec	Comm Cen Sec	Instl Sec	Tel Sec	Radio Sec	Co Total	Signal Battalion Total
	9								1					2	3	12
																2
																2
	2	2													2	6
	1	1													1	3
	8	2	2		2			2							8	16
	3	1	1		1			1							4	8
	6							2			2				4	16
																2
																4
	3													1	1	6
	15				4		1	2			2			2	11	60
																2
	3							1			1				2	8
																2
	3															4
	1	1	1		1	1			1						5	9
					7										7	11
																5
																3
	3													1	1	6
	3					1			1						2	10
																2
	9				4		1							2	7	22
4	12				3					4					7	21
					7										7	19
																7
	3							1			1				2	8
																3
																3
																3
																3
																3
																3
																3
																3
																3
																3
	2	1							1						2	7
4	12				10					4					14	40
																3
																3
																3
																6
																3
	9								1					2	3	20
																3
																3
																3
																3
																3
																3
																3
																3
																3
	3							1					1		2	9

CHART B-1 SIGNAL EQUIPMENT AUTHORIZED TO THE SIGNAL BATTALION (TOE 11-35H)

Line Item No.	Description	HEADQUARTERS AND HEADQUARTERS COMPANY										COMMAND OPERATIONS COMPANY									FORWARD COMMUNICATION COMPANY						SIGNAL SUPPORT OPERATIONS COMPANY																					Signal Battalion Total
		Co Hq	Admin-Log Sec	Op-Intel Sec	Div Sig Off Sec	Bn Motor Maint Sec	C-E Maint Sec	Comsec Log Sec	Air-Weather Spt Sec	Photo Sec	Hq & Hq Co Total	Co Hq	Comd Sig Cen Plt Hq (2)	Comm Cen Sec	Tel Sec	Radio Sec	Multichannel Comm Tml Sec (2)	Cable Instl Sec	Comd Op Co Total	Co Hq	Fwd Sig Cen Plt Hq (3)	Comm Cen Sec (3)	Tel Sec (3)	Radio Sec (3)	Instl Sec (3)	Multichannel Comm Sec (3)	Fwd Comm Co Total	Co Hq	Fld Cable Instl Plt Hq	Cable Instl Tm's (8)	Multichannel Comm Rett Sec	Rear Ech Op Plt Hq	Radio Tty Tm	Comm Cen Sec	Spt-Comm Op Plt Hq	Multichannel Comm Tml Sec	Comm Cen Sec	Instl Sec	Tel Sec	Radio Sec	Co Total	
	ANTENNAS																																													
A72260	RC-292			1							1		1			6			8		1			2		9							1						2	3	12
M14381	Mast: AB-903/G															2			2																							2
Z05012	AS-1729/VRC															2			2																							2
	RADIAC																																												
E00533	Charger Radiac Detector: PP-1578/PD	2									2	2							2	2						2	2													2	6
Q19339	Radiac Set: AN/PDR-27	1									1	1							1	1						1	1													1	3
Q20935	Radiac Meter: IM-93/UD	2									2	2	2						6	2	2					8	2	2		2			2						8	16
Q21483	Radiac Meter: IM-174/PD	1									1	1	1						3	1	(2)					3	1	1		1			1						4	8
	RADIO																																												
E24281	Cipher Machine: TSEC/KL-7													6					6			2				6							2						4	16
E45766	Code Changer Key: KIK-18/TSEC							2			2																														2
E45820	Code Changer Key: KYK-28/TSEC		1	1	1						3					1			1																						4
E92915	Control Radio Set: AN/GSA-7															2			2					1		3													1	1	6
H02300	Elec TTY Secure Equip: TSEC/KW-7							3	7		10			18		6			24			2		3		15				4		1	2			2			2	11	60
K98250	Inter Computer: KIR-1A/TSEC							2			2																														2
L24903	Keyboard Adapter: KLX-7/TSEC													3					3			1				3							1			1			2	8
Q33163	AN/GRC-106 Mtd in Truck 3/4-ton															2			2																						2
Q38299	AN/PRC-77																				1					3															4
Q53926	AN/VRC-46 Mtd in Truck 1/4-ton		2								2	1							1	1						1	1	1		1	1		1						5	9
Q54037	AN/VRC-46 Mtd in Truck 3/4-ton												1			2			4											7									7	11
Q54174	AN/VRC-47				1						1		2						4																						5
Q54618	AN/VRC-47 Mtd in Truck 1/4-ton		1	1	1						3																														3
Q55373	AN/VRC-49 Mtd in Truck 3/4-ton															2			2					1		3													1	1	6
Q78282	Radio Set Con Gp: AN/GRA-39			1							1		1			2			4		1					3					1		1						2	10
Z56480	Radio Set Con Gp: AN/GRA-74															2			2																						2
Q90120	Radio TTY Set: AN/GRC-142															6			6					3		9				4		1						2	7	22
Q92894	Radio Terminal Set: AN/TRC-145																1		2							12				3				4					7	21
R78062	Repeater Set Radio: AN/TRC-113																6		12											7									7	19
U01305	Speech Secure Equip: TSEC/KY-38		2	1	2						5						2		2																						7
V23142	Tape Reader: TSEC/HL-1													3					3			1				3							1			1			2	8
K14403	Handset: H-33/PT						3				3																														3
N20115	Op Cent Comm: AN/MSC-31		1		2						3																														3
	TOOLS AND TEST EQUIP																																											
H01907	Elec Shop Avionics: AN/ASM-146						3				3																														3
H01912	Elec Shop Avionics: AN/ASM-147						3				3																														3
J01004	Frequency Meter: AN/USM-159						3				3																														3
J52549	Generator Signal: AN/URM-25						3				3																														3
J53682	Generator Signal: AN/URM-103						3				3																														3
J53712	Generator Signal: AN/URM-127						3				3																														3
J53782	Generator Signal: AN/USM-44						3				3																														3
J53944	Generator Signal: AN/USM-205						3				3																														3
J55289	Generator Signal: SG-71/FCC						3				3																														3
M80002	Multimeter: AN/URM-105					1				1	2	1							1		(2)					2	1			1				1					2	7
M80242	Multimeter: AN/USM-223						8	6			14														4	12				10				4					14	40
M80276	Multimeter: ME-26/U						3				3																														3
M80413	Multimeter: ME-30/U						3				3																														3
M81783	Multimeter: TS-585/U						3				3																														3
N30572	Oscilloscope: AN/USM-281						6				6																														6
P37492	Power Supply: PP-1243/U						3				3																														3
P38588	Power Supply: PP-2953/U			1	1						2		1			4			6		1			2		9							1						2	3	20
U54346	Stroboscope: TS-805/U						3				3																														3
V76108	Test Set Electron Tube: TV-7/U						3				3																														3
V76519	Test Set Elct Circuit: AN/GRM-55						3				3																														3
V88027	Test Set Radio: AN/VRM-1						3				3																														3
V89534	Test Set Radio Freq: AN/URM-120						3				3																														3
V90972	Test Set Relay: TS-1775/U						3				3																														3
V91863	Test Set Semiconductor: TS-1836/U						3				3																														3
V93575	Test Set Subassembly: TS-402/U						3				3																														3
V94466	Test Set Telephone: AN/USM-181						3				3																														3
V94740	Test Set Telephone: TS-26/TSM																	4	4				1			3								1					2	9

5H)—Continued

SIGNAL SUPPORT OPERATIONS COMPANY															
[illegible]	Cable Instl Tm's (8)	Multichannel Comm Radt Sec	Rear Ech Op Plt Hq	Radio Tty Tm	Comm Cen Sec	Spt-Comm Op Plt Hq	Multichannel Comm Tml Sec	Comm Cen Sec	Instl Sec	Tel Sec	Radio Sec	Co Total		Signal Battalion Total
														3
														14
														3
														1
														4
1												8		24
														3
														12
		10					4					14		40
									10			10		57
														9
														9
														1
	1								2			3		17
														2
														2
														2
														1
														2
														1
														1
														1
														2
														3
														3
														2
														4
														6
														2
														1
														6
														6
														1
					1				2			3		13e
											1	1		6
	4											32		
	32											256		316
		20			20		24	3	10	6		83		338
		8					8		4			20		74
			2	1	10	2					6	21		116
									15			15		75
										1		1		7
														4
														3
					1					1		2		5
					1			1				2		5
														1
		3			2		4		4			13		50
	1								2			10		17
	1				2				2			12		22
			1	1		1					3	6		41
														12
	(66)											66		78
										1		1		9
														6
	2				20				4	35		75		286
														3
											1	1		6
														1

CHART B-2 SIGNAL EQUIPMENT AUTHORIZED TO THE HEADQUARTERS AND HEADQUARTERS COMPANY, ARMORED DIVISION BRIGADE (TOE 17-42H)

Line Item No.	DESCRIPTION	Co Hq	Staff Sec	Liaison Sec	Comm Plt Hq	Message Cen-Wire Section	Radio Sec	Aviation Section	Total
	ANTENNAS								
A72260	Antenna: RC-292	1	3		2		1		7
	RADIAC								
A21246	Aerial Radiac System: AN/ADR-6							2	2
E00533	Charger Radiac Detector: PP-1578	2							2
Q19339	Radiac Set: AN/PDR-27		1					3	4
Q20935	Radiac Meter: IM-93/UD	2	4		2			4	12
Q21483	Radiac Meter: IM-174/UD	1	2					2	5
	RADIO								
H02300	Elec TTY Secure Equip: TSEC/KW-7					2	1		3
Q32867	AN/GRC-106 Carr Comd Post Lt		1						1
Q38299	AN/PRC-77						5		5
Q42092	AN/PRC-90							8	8
Q53112	AN/VRC-46 Carrier Comd Post		2				2		4
Q53556	AN/VRC-46 Recov Veh Lt Armd	1							1
Q53926	AN/VRC-46 Truck 1/4-ton		5						5
Q53944	AN/VRC-46 Truck 1-1/4-ton Cargo	1							1
Q54285	AN/VRC-47 Carrier Comd Post		2						2
Q54618	AN/VRC-47 Truck 1/4-ton		1						1
Q54636	AN/VRC-47 Truck 1-1/4-ton Cargo							1	1
Q55299	AN/VRC-49 Truck 1/4-ton				1				1
Q78282	Control Group: AN/GRA-39		2				1		3
Z56480	Control Group: AN/GRA-74		1						1
Q91302	TTY Set: AN/VSC-3						1		1
L83413	Loudspeaker: LS-166/U		1						1
U01275	Speech Secure Equip: TSEC/KY-8		3						3
V08721	Tactical Repeater: HYL-3/TSEC				1				1
	STANO								
M35691	Metascope: AN/PAS-6	2							2
	TOOLS AND TEST EQUIP								
K73763	Indicator Channel Align: ID-1189						1		1
V76108	Test Set Electron Tube: TV-7/U						1		1
W37483	Tool Kit Elec Equip: TK-101/GSQ						1		1
M80002	Multimeter: AN/URM-105	2					1		3
	WIRE								
B07126	Axle Cable Reel: RL-27								
C68719	WD-1-TT DR-8				4	5			9
C68856	WD-1/TT TL-159/U					40			40
C68993	WD-1/TT 2 Cdt Fld Wire					20			20
D79481	Cent Off Telephone: AN/TTC-29					2			2
L00984	Inverter Vibrator: PP-1703/U						1		1
R55783	Reel Cable: RL-159/U					9			9
R59023	Reeling Machine: RL-31					2			2
R59160	Reeling Machine: RL-39						1		1
R59434	Reeling Machine: RL-172/G					3			3
U81707	Switchboard: SB-22/PT					2			2
V31211	Telephone: TA-312/PT	1	11	1		5	2	1	21
V41968	TTY Set: AN/GGC-3					1			1
V42105	TTY Set: AN/PGC-1					1			1
V57914	Terminal: TN/TCC-29					2			2

CHART B-1 SIGNAL EQUIPMENT AUTHORIZED TO THE SIGNAL BATTALION (TOE 11-35H)—Continued

Line Item No.	Description	HEADQUARTERS AND HEADQUARTERS COMPANY										COMMAND OPERATIONS COMPANY								FORWARD COMMUNICATION COMPANY									SIGNAL SUPPORT OPERATIONS COMPANY																
		Co Hq	Admin-Log Sec	Op-Intel Sec	Div Sig Off Sec	Bn Motor Maint Sec	C-E Maint Sec	Comsec Log Sec	Air-Weather Spt Sec	Photo Sec	Hq & Hq Co Total	Co Hq	Comd Sig Cen Plt Hq (2)	Comm Cen Sec	Tel Sec	Radio Sec	Multichannel Comm Tml Sec (2)	Cable Instl Sec	Comd Op Co Total	Co Hq	Fwd Sig Cen Plt Hq (3)	Comm Cen Sec (3)	Tel Sec (3)	Radio Sec (3)	Instl Sec (3)	Multichannel Comm Sec (3)	Fwd Comm Co Total	Co Hq	Fld Cable Instl Plt Hq	Cable Instl Tm's (8)	Multichannel Comm Radit Sec	Rear Ech Op Plt Hq	Radio Tty Tm	Comm Cen Sec	Spt-Comm Op Plt Hq	Multichannel Comm Tml Sec	Comm Cen Sec	Instl Sec	Tel Sec	Radio Sec	Co Total	Signal Battalion Total
V95151	Test Set Telephone: TS-190/U						3				3																																3
V96521	Test Set Telephone: AN/PTM-7						4				4						3	4	10																								14
V97617	Test Set TTY: AN/UGM-1						3				3																																3
W02776	Tester Flash Gun: LM-66									1	1																																1
W27798	Tool Equip Telephone						3				3				1				1																								4
W29716	Tool Kit: TTY Maint						7	4			11	3							3	2						2		1													8	24
W37251	Tool Kit Elec Equip: TK-100/G						3				3																																3
W37388	Tool Kit Elec Equip: TK-105/G						6	6			12																																12
W37483	Tool Kit Elec Equip: TK-101/GSQ																7		14							4	12				10					4					14	40
W43974	Tool Kit Lineman																	26	26						7		21											10			10	57
W57253	Tool Kit Telephone Terminal						3				3						3		6																								9
C20551	Bridge-Cap-Induct-Rest: AN/URM-90						3				3																																9
W47663	Tool Kit Photographic Repair									1	1																																1
D05008	Splicing Kit Tel Cable: MK-356/G																	8	8						2		6			1							2			3	17
	VISUAL																																										
C84638	Camera Set Still: KS-19									2	2																																2
C82994	Camera Motion Picture: KS-10									2	2																																2
C83897	Camera Still Picture: KS-98									2	2																																2
C84227	Camera Still Picture: KS-15									1	1																																1
C84775	Camera Still Picture: KS-4									2	2																																2
N86514	Darkroom Portable: ES-82									1	1																																1
L35828	Lamp Equipment: PH-218									1	1																																1
L51637	Lens Camera: LE-2									1	1																																1
L76214	Loader Film: LM-17									1	1																																1
M38746	Meter Photographic: LM-46									2	2																																2
N57705	Panel Set: AP-30-C	3									3																																3
N57842	Panel Set: AP-30-D	3									3																																3
P76564	Projector Motion Picture: AS-2									2	2																																2
P77536	Projector Still Picture: AP-9									4	4																																4
S59222	Screen Projection: BM-10									6	6																																6
Z26854	Facsimile Set: AN/GXC-5													2					2																								2
Z60293	Receiver Facsimile: R-1063/GX								1		1																																1
	WIRE																																										
V57914	Terminal Telegraph-Tel: AN/TCC-29								6		6																																6
V39776	Teletypewriter Set: AN/FGC-25								6		6																																6
V36214	Teletypewriter: TT-4/TG								1		1																																1
B07126	Axle Cable Reel: RL-27																	4	4						2		6							1			2			3	13
C63581	Cable Assy: CX-7474/U															2			2					1			3												1	1	6
C63630	Cable Assy: CX-11230/G-100 ft																	30	30											4										32	
C63645	Cable Assy: CX-11230/G-1/4 mi																	60	60											32										256	316
C66253	Cable Assy: CX-4566/G														20		20	30	90			3	10		10	32	165				20			20		24	3	10	6	83	338
C66390	Cable Assy Tel: CX-4760/U																4	10	18						4	8	36				8					8		4		20	74
C68719	Cable Tel: WD-1/TT, DR-8	4		2					6		12		2			30		24	56		2			7		27					2	1	10	2					6	21	116
C68856	Cable Tel: WD-1/TT, RL-159																								20		60											15			15	75
D77886	Center Comm Patching: AN/TSC-76				1						1				3				3				1				3							1					1	1	7
D78271	Center Message: AN/GSQ-80													3					3																							4
D79476	Center Off Tel: AN/TTC-23														3				3																							3
D79481	Center Off Tel: AN/TTC-29																					1					3							1				1		2	5
D80116	Central Off TTY: AN/TGC-30																										3							1						2	5
F03595	Converter Sig Data: CV-2/TX													1					1																							1
G26890	Distribution Box: J-1077A/U																	10	4						5	4	27				3					4				13	50
R58854	Reeling Machine: RL-207/G																	4	4						1		3			1							2			10	17
R59023	Reeling Machine: RL-31																	4	4						2		6			1				2			2			12	22
R59160	Reeling Machine: RL-39	1		1					5		7		1			12			13		1			4		15					1	1		1					3	6	41
R60360	Repeater Tel: TA-287/G																	12	12											(66)										66	78
R88196	Restorer Pulse Form: TD-206/G																	12	12																							12
U81707	Switchboard: SB-22/PT	1							2		3				2				2				1				3												1	1	9
V28143	Telephone Terminal: AN/TCC-65																3		6																							6
V31211	Telephone Set: TA-312/PT	12							7		19				112			8	120				20	1	3		72			2				20			4	35		75	286
V57503	Terminal Telegraph: AN/TSC-58													3					3																							3
Z76749	Switchboard Assy Kit: MX-230/PT															2			2					1			3												1	1	6
R60908	Reperforator TTY: TT-207/FG								1		1																																1

CHART B-2 SIGNAL EQUIPMENT AUTHORIZED TO THE HEADQUARTERS AND HEADQUARTERS COMPANY, ARMORED DIVISION BRIGADE (TOE 17-42H)

Line Item No.	DESCRIPTION	Co Hq	Staff Sec	Liaison Sec	Comm Plt Hq	Message Cen-Wire Section	Radio Sec	Aviation Section	Total
	ANTENNAS								
A72260	Antenna: RC-292	1	3		2		1		7
	RADIAC								
A21246	Aerial Radiac System: AN/ADR-6							2	2
E00533	Charger Radiac Detector: PP-1578	2							2
Q19339	Radiac Set: AN/PDR-27		1					3	4
Q20935	Radiac Meter: IM-93/UD	2	4		2			4	12
Q21483	Radiac Meter: IM-174/UD	1	2					2	5
	RADIO								
H02300	Elec TTY Secure Equip: TSEC/KW-7					2	1		3
Q32867	AN/GRC-106 Carr Comd Post Lt		1						1
Q38299	AN/PRC-77						5		5
Q42092	AN/PRC-90							8	8
Q53112	AN/VRC-46 Carrier Comd Post		2				2		4
Q53556	AN/VRC-46 Recov Veh Lt Armd	1							1
Q53926	AN/VRC-46 Truck 1/4-ton		5						5
Q53944	AN/VRC-46 Truck 1-1/4-ton Cargo	1							1
Q54285	AN/VRC-47 Carrier Comd Post		2						2
Q54618	AN/VRC-47 Truck 1/4-ton		1						1
Q54636	AN/VRC-47 Truck 1-1/4-ton Cargo							1	1
Q55299	AN/VRC-49 Truck 1/4-ton				1				1
Q78282	Control Group: AN/GRA-39		2				1		3
Z56480	Control Group: AN/GRA-74		1						1
Q91302	TTY Set: AN/VSC-3						1		1
L83413	Loudspeaker: LS-166/U		1						1
U01275	Speech Secure Equip: TSEC/KY-8		3						3
V08721	Tactical Repeater: HYL-3/TSEC				1				1
	STANO								
M35691	Metascope: AN/PAS-6	2							2
	TOOLS AND TEST EQUIP								
K73763	Indicator Channel Align: ID-1189						1		1
V76108	Test Set Electron Tube: TV-7/U						1		1
W37483	Tool Kit Elec Equip: TK-101/GSQ						1		1
M80002	Multimeter: AN/URM-105	2					1		3
	WIRE								
B07126	Axle Cable Reel: RL-27								
C68719	WD-1-TT DR-8				4	5			9
C68856	WD-1/TT TL-159/U					40			40
C68993	WD-1/TT 2 Cdt Fld Wire					20			20
D79481	Cent Off Telephone: AN/TTC-29					2			2
L00984	Inverter Vibrator: PP-1703/U						1		1
R55783	Reel Cable: RL-159/U					9			9
R59023	Reeling Machine: RL-31					2			2
R59160	Reeling Machine: RL-39						1		1
R59434	Reeling Machine: RL-172/G					3			3
U81707	Switchboard: SB-22/PT					2			2
V31211	Telephone: TA-312/PT	1	11	1		5	2	1	21
V41968	TTY Set: AN/GGC-3					1			1
V42105	TTY Set: AN/PGC-1					1			1
V57914	Terminal: TN/TCC-29					2			2

CHART B-3 SIGNAL EQUIPMENT AUTHORIZED TO THE TANK

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS COMPANY											TANK COMPA			
		Co Hq	Bn Hq Sec	Hq Tk Sec	Comm Plt	Spt Plt Hq	Maint Plt	Aid Sta Sec	Evac Sec	HHC Maint Sec	Med Plt Hq	Total	Hq Sec	Maint Sec	Tk Plt (3)	
	ANTENNAS															
A71438	AT-784															
A72260	RC-292		3		2							5	1			
	RADIAC															
E00533	Charger Radiac Detector: PP-1578/PD									2	1	3	3			
Q19339	Radiac Set: AN/PDR-27										1	1				
Q21483	Radiac Meter: IM-174/PD	1			1	1	1			1	1	6	1	1	1	
Q20935	Radiac Meter: IM-93/UD	2	4		2	2	2			2	2	16	2	1	2	
	RADIO															
U01275	Speech Scty Equip: TSEC/KY-8		2									2				
H02300	Elec TTY Sec Equip: TSEC/KW-7				1							1				
K23814	Headset-Microphone: H-182/PT															
K93373	Intercom Set: AN/VIC-1	1										1				
Q34311	AN/GRC-160 Mtd 107-mm Mortar															
Q34312	AN/GRC-160 Mtd Carr Comd & Recon															
Q34326	AN/GRC-160 Mtd 1/4-ton Truck															
Q34327	AN/GRC-160 Mtd 3/4-ton Truck															
Q38299	AN/PRC-77															
Q45779	AN/VRC-12															
Q45945	AN/VRC-12 Mtd Tank 105-mm Gun			3								3	2		2	
Q53112	AN/VRC-46 Mtd Carr Comd Post		2									2				
Q53223	AN/VRC-46 Mtd Carr Recon															
Q53556	AN/VRC-46 Mtd Recov Veh						1					1				
Q53741	AN/VRC-46 Mtd Tk Recov Veh						2					2		1		
Q53926	AN/VRC-46 Mtd Trk 1/4-ton	1	4				1					6				
Q54037	AN/VRC-46 Mtd Trk 3/4-ton															
Q54285	AN/VRC-47 Mtd M557		2									2				
Q54322	AN/VRC-47 Mtd Carr Pers FTA															
Q54618	AN/VRC-47 Mtd Trk 1/4-ton		2			1						3	1	1		
Q55299	AN/VRC-49 Mtd Trk 1/4-ton				1											
Q56787	AN/VRC-64 Mtd Carr Pers FTA								3			4		1		
Q56788	AN/VRC-64 Carr Comd Post							1				1				
Q56793	AN/VRC-64 Mtd Launch Tk Chassis															
Q56798	AN/VRC-64 Tk Combat Full Track														3	
Q56805	AN/VRC-64 Trk 1-1/4-ton Cargo	1										1				
Q56804	AN/VRC-64 Truck 1/4-ton									1		1				

CHART B-3 SIGNAL EQUIPMENT AUTHORIZED TO THE TANK BATTALION (TOE 17-35H)

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS COMPANY											TANK COMPANY				COMBAT SUPPORT COMPANY											
		Co Hq	Bn Hq Sec	Hq Tk Sec	Comm Plt	Spt Plt Hq	Maint Plt	Aid Sta Sec	Evac Sec	HHC Maint Sec	Med Plt Hq	Total	Hq Sec	Maint Sec	Tk Plt (3)	Total	Co Hq	Maint Sec	Bn Gnd Surv Sec	Sct Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Armd Veh Brg Sec	Redeye Sec Hq	Redeye Tm (5)	Cbt Spt Co Total	Bn Total
	ANTENNAS																											
A71438	AT-784																				1						2	2
A72260	RC-292		3		2							5	1			1	1										1	9
	RADIAC																											
E00533	Charger Radiac Detector: PP-1578/PD									2	1	3	3			3		2									2	14
Q19339	Radiac Set: AN/PDR-27										1	1					1										1	2
Q21483	Radiac Meter: IM-174/PD	1			1	1	1			1	1	6	1	1	1	5		1			2	1					6	27
Q20935	Radiac Meter: IM-93/UD	2	4		2	2	2			2	2	16	2	1	2	9	2	2			2	2					10	53
	RADIO																											
U01275	Speech Scty Equip: TSEC/KY-8		2									2																2
H02300	Elec TTY Sec Equip: TSEC/KW-7				1							1																1
K23814	Headset-Microphone: H-182/PT																					6						6
K93373	Intercom Set: AN/VIC-1	1										1																1
Q34311	AN/GRC-160 Mtd 107-mm Mortar																						1				4	4
Q34312	AN/GRC-160 Mtd Carr Comd & Recon																				2						4	4
Q34326	AN/GRC-160 Mtd 1/4-ton Truck																		3							(2)		5
Q34327	AN/GRC-160 Mtd 3/4-ton Truck																									1	5	5
Q38299	AN/PRC-77																					3				(3)		6
Q45779	AN/VRC-12																			1							1	1
Q45945	AN/VRC-12 Mtd Tank 105-mm Gun			3								3	2		2	8												27
Q53112	AN/VRC-46 Mtd Carr Comd Post		2									2																2
Q53223	AN/VRC-46 Mtd Carr Recon																				2						4	4
Q53556	AN/VRC-46 Mtd Recov Veh						1					1						1									1	2
Q53741	AN/VRC-46 Mtd Tk Recov Veh						2					2		1		1												5
Q53926	AN/VRC-46 Mtd Trk 1/4-ton	1	4				1					6							1			3					4	11
Q54037	AN/VRC-46 Mtd Trk 3/4-ton																											1
Q54285	AN/VRC-47 Mtd M557		2									2										1					1	3
Q54322	AN/VRC-47 Mtd Carr Pers FTA																			1							2	2
Q54618	AN/VRC-47 Mtd Trk 1/4-ton		2			1						3	1	1		2	1					1			1		3	12
Q55299	AN/VRC-49 Mtd Trk 1/4-ton				1																							1
Q56787	AN/VRC-64 Mtd Carr Pers FTA								3			4		1		1												6
Q56788	AN/VRC-64 Carr Comd Post							1				1										1					1	2
Q56793	AN/VRC-64 Mtd Launch Tk Chassis																							2			2	2
Q56798	AN/VRC-64 Tk Combat Full Track														3	9												27
Q56805	AN/VRC-64 Trk 1-1/4-ton Cargo	1										1						1									1	2
Q56804	AN/VRC-64 Truck 1/4-ton									1		1																1

BATTALION (TOE 17-35H)

COMBAT SUPPORT COMPANY											
Co Hq	Maint Sec	Bn Gnd Survl Sec	Sct Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Armd Veh Brg Sec	Redeye Sec Hq	Redeye Tm (5)	Cbt Spt Co Total	Bn Total
				1						2	2
1										1	9
	2									2	14
1										1	2
	1			2	1					6	27
2	2			2	2					10	53
											2
											1
					6						6
											1
						1				4	4
				2						4	4
		3							(2)		5
									1	5	5
					3				(3)		6
			1							1	1
											27
											2
				2						4	4
	1									1	2
											5
		1			3					4	11
											1
					1					1	3
			1							2	2
1					1			1		3	12
											1
											6
					1					1	2
							2			2	2
											27
	1									1	2
											1

(TOE 17-35H)—Continued

COMBAT SUPPORT COMPANY									
Bn Gnd Survl Sec	Sct Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Armd Veh Brg Sec	Redeye Sec Hq	Redeye Tm (5)	Cbt Spt Co Total	Bn Total
						1		2	27
									1
						1			
4	4	4	8	1		1	1	35	15
	2	4						10	2
									10
									1
4	2		2	1		1	1	19	45
			1					2	2
			1					1	6
							2	10	22
4	1		6	1				18	37
									1
									2
	4							4	18
	2	4	1	1				15	75
		2						6	8
									54
4								4	4
			3					3	6
5		2						12	32
4								4	4
								1	6
									1
									1
1									1
								1	5
								1	6
1								1	1
								1	1
								1	5

CHART B-4 SIGNAL EQUIPMENT AUTHORIZED TO THE ARMORED
(TOE 17-105H)

		HEADQUARTERS AND HEADQUARTERS TROOP												
Line Item No.	DESCRIPTION	Trp Hq	Sqdn Hq Sec	Sqdn Comm Plt	Sqdn Spt Plt Hq	Sup Sec	Sqdn Maint Plt	Sqdn Med Plt Hq	Aid Sta Sec	Evac Sec	Redeye Sec Hq	Redeye TM's (5)	Hq & Hq Trp Total	Hq Sec
	ANTENNAS													
A71438	AT-784/PRC													
A71712	AT-984/G			2									2	
A72260	RC-292		3	2	1		2						8	1
	RADIAC													
A21246	Aerial Radiac System: AN/ADR-6													
E00533	Charger Radiac Detector: PP-1578/PD	4						1					5	5
Q19339	Radiac Set: AN/PDR-27							1					1	1
Q20935	Radiac Meter: IM-93/UD	2		2	2		2	2					10	2
Q21483	Radiac Meter: IM-174/PD	1		1	1		1	1					5	1
	RADIO													
E45820	Code Changer Key: KYK-28/TSEC													
H02300	Elec TTY Scty Equip: TSEC/KW-7			2									2	
L83413	Loudspeaker: LS-166/U		3		1								4	1
Q32867	AN/GRC-106 Mtd Carrier Comd Post		2										2	
Q32904	AN/GRC-106 Mtd Carrier Personnel													1
Q33107	AN/GRC-106 Mtd Truck 1-1/4-ton Cargo													
Q34313	AN/GRC-160 Mtd Carrier Personnel													
Q34327	AN/GRC-160 Mtd Truck Util 1-1/4-ton Cargo											(2)	2	
Q37982	AN/PRC-41													
Q38299	AN/PRC-77											(3)	3	
Q38335	AN/PRC-90													
Q45779	AN/VRC-12		2										2	1
Q45797	AN/VRC-12 Armd Recon Abn Aslt Veh													
Q53112	AN/VRC-46 Carrier Comd Post		2	1									3	
Q53556	AN/VRC-46 Recovery Vehicle Light Armd						2						2	
Q53926	AN/VRC-46 Mtd Truck 1/4-ton		4		1		1						6	
Q53944	AN/VRC-46 Mtd Truck Util 1-1/4-ton						1						1	
Q54285	AN/VRC-47 Carrier Comd Post		2										2	
Q54322	AN/VRC-47 Mtd Carrier Personnel													1
Q54618	AN/VRC-47 Mtd Truck 1/4-ton		2										2	1
Q54636	AN/VRC-47 Mtd Truck 1-1/4-ton										1		5	
Q55299	AN/VRC-49 Mtd Truck 1/4-ton			1									1	
Q56784	AN/VRC-64 Armd Recon Abn Aslt Veh													
Q56786	AN/VRC-64 Carrier 107-mm Mortar													
Q56787	AN/VRC-64 Mtd Carrier Personnel									3			3	
Q56788	AN/VRC-64 Carrier Comd Post								1				1	
Q56804	AN/VRC-64 Truck Util 1/4-ton	1						1					2	
Q56805	AN/VRC-64 Truck Util 1-1/4-ton	1											1	
Q78282	Radio Set Cont Gp: AN/GRA-39		3	2							1		6	1
Q91302	Radio TTY Set: AN/VSC-3			2									2	
R29799	Receiver Set Rdo: AN/PRR-9													
U01275	Speech Secure Eq: TSEC/KY-8		2										2	
U01295	Speech Secure Eq Abn: TSEC/KY-28													

CHART B-3 SIGNAL EQUIPMENT AUTHORIZED TO THE TANK BATTALION (TOE 17-35H)—Continued

		HEADQUARTERS AND HEADQUARTERS COMPANY											TANK COMPANY				COMBAT SUPPORT COMPANY											
Line Item No.	DESCRIPTION	Co Hq	Bn Hq Sec	Hq Tk Sec	Comm Plt	Spt Plt Hq	Maint Plt	Aid Sta Sec	Evac Sec	HHC Maint Sec	Med Plt Hq	Total	Hq Sec	Maint Sec	Tk Plt (3)	Total	Co Hq	Maint Sec	Bn Gnd Survl Sec	Sct Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Armd Veh Brg Sec	Redeye Sec Hq	Redeye Tm (5)	Cbt Spt Co Total	Bn Total
Q78282	Control Grp: AN/GRA-39		3	2	2							7	2		1	5	1								1		2	27
Q91302	Radio TTY Set: AN/VSC-3				1							1																1
Q54636	AN/VRC-47 Trk 1-1/4-ton																								1			
Q53186	AN/VRC-46 Carrier Pers FTA		1																									
	WIRE																											
C68719	WD-1/TT DR-8		12	3	8							23	10		3	19	1		4	4	4	8	1		1	1	35	15
C68856	WD-1/TT RL-159/U				2							2								2	4						10	2
R56742	Reel Equip: CE-11																											10
R59023	Reel Machine Cable Hand: RL-31				1							1																1
R59160	Reel Machine Cable Hand: RL-39		3	2	3							8	3		1	6	1		4	2		2	1		1	1	19	45
U81707	Switchboard: SB-22/PT																1					1					2	2
U82529	Switchboard: SB-993/GT				2							2	1			1						1					1	6
V30252	Telephone: TA-1/PT												1		1	4										2	10	22
V31211	Telephone: TA-312/PT	1	5		1	1	1			1		10	3			3	3		4	1		6	1				18	37
B07126	Axle Cable Reel: RL-27				1							1																1
V54548	Terminal Board: TM-184				2							2																2
	STANO																											
M35691	Metascope: AN/PAS-6		2									2	1		1	4				4							4	18
N04593	Night Vision Sight: AN/TVS-2			3								3	2	2	5	19				2	4	1	1				15	75
N04730	Night Vision Sight: AN/PVS-2	1							1			2	1				1	1			2						6	8
S67421	Searchlight: Xenon			3								3	2		5	17												54
Q16110	Radar: AN/PPS-5																		4								4	4
N15510	Night Vision Sight: AN/TVS-4												1			1						3					3	6
B67423	Binocular Elec: AN/PAS-5		8									8	3	3		6	2	1	5		2						12	32
	TOOLS AND TEST EQUIP																											
D99419	Charger Battery: PP-4127/U													1					4								4	4
M80002	Multimeter: AN/URM-105				1		1					2		1		1		1									1	6
M80242	Multimeter: AN/USM-223				1							1																1
V69258	Test Battery: AN/PSM-13				1							1																1
V74738	Test Set Elec Power: AN/UPM-93				1							1							1									1
V76108	Test Set Electron Tube: TV-7/U				1							1		1		1		1									1	5
W37483	Tool Kit: Tk-101/GSQ				2							2		1		1		1									1	6
Y38404	Wattmeter: AN/URM-93																		1								1	1
V88027	Test Set Radio: AN/VRM-1													1													1	1
L00984	Inverter-Vibrator: PP-1703/U				1							1		1		1		1									1	5

CHART B-4 SIGNAL EQUIPMENT AUTHORIZED TO THE ARMORED CAVALRY SQUADRON (DIVISIONAL) (TOE 17-105H)

		HEADQUARTERS AND HEADQUARTERS TROOP												ARMD CAV TRP					AIR CAVALRY TROOP							
Line Item No.	DESCRIPTION	Trp Hq	Sqdn Hq Sec	Sqdn Comm Plt	Sqdn Spt Plt Hq	Sup Sec	Sqdn Maint Plt	Sqdn Med Plt Hq	Aid Sta Sec	Evac Sec	Redeye Sec Hq	Redeye TM's (5)	Hq & Hq Trp Total	Hq Sec	Gnd Surv Sec	Maint Sec	Armd Cav Plt (3)	Armd Cav Trp Total	Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Sup Sec	Air Cav Trp Total	Armd Cav Sqdn Total
	ANTENNAS																									
A71438	AT-784/PRC																1	3								9
A71712	AT-984/G			2									2					2								6
A72260	RC-292		3	2	1		2						8	1				1		1					1	12
	RADIAC																									
A21246	Aerial Radiac System: AN/ADR-6																							2	2	2
E00533	Charger Radiac Detector: PP-1578/PD	4						1					5	5				5						5	5	25
Q19339	Radiac Set: AN/PDR-27							1					1	1				1	1						1	5
Q20935	Radiac Meter: IM-93/UD	2		2	2		2	2					10	2		2	3	13	2	3	10	6	10	2	33		82
Q21483	Radiac Meter: IM-174/PD	1		1	1		1	1					5	1		1		2	1		5	5	5	1		17	28
	RADIO																									
E45820	Code Changer Key: KYK-28/TSEC																			1	4	2	3	1	1	12	12
H02300	Elec TTY Scty Equip: TSEC/KW-7			2									2														2
L83413	Loudspeaker: LS-166/U		3		1								4	1				1									7
Q32867	AN/GRC-106 Mtd Carrier Comd Post		2										2														2
Q32904	AN/GRC-106 Mtd Carrier Personnel													1				1									3
Q33107	AN/GRC-106 Mtd Truck 1-1/4-ton Cargo																			1						1	1
Q34313	AN/GRC-160 Mtd Carrier Personnel														2			2									6
Q34327	AN/GRC-160 Mtd Truck Util 1-1/4-ton Cargo											(2)	2														2
Q37982	AN/PRC-41																							2	2	2
Q38299	AN/PRC-77											(3)	3				1	3			3	5	1			9	21
Q38335	AN/PRC-90																		2		20	10	18	2	2	54	54
Q45779	AN/VRC-12		2										2	1				1									5
Q45797	AN/VRC-12 Armd Recon Abn Aslt Veh																1	3									9
Q53112	AN/VRC-46 Carrier Comd Post		2	1									3														3
Q53556	AN/VRC-46 Recovery Vehicle Light Armd						2						2			1		1									5
Q53926	AN/VRC-46 Mtd Truck 1/4-ton		4		1		1						6														6
Q53944	AN/VRC-46 Mtd Truck Util 1-1/4-ton						1						1														1
Q54285	AN/VRC-47 Carrier Comd Post		2										2														2
Q54322	AN/VRC-47 Mtd Carrier Personnel													1				1									3
Q54618	AN/VRC-47 Mtd Truck 1/4-ton		2										2	1		1		2	1	1				1		3	11
Q54636	AN/VRC-47 Mtd Truck 1-1/4-ton										1		5							1						1	6
Q55299	AN/VRC-49 Mtd Truck 1/4-ton			1									1														1
Q56784	AN/VRC-64 Armd Recon Abn Aslt Veh																1	3									9
Q56786	AN/VRC-64 Carrier 107-mm Mortar																1	3									9
Q56787	AN/VRC-64 Mtd Carrier Personnel									3			3			1	1	4									15
Q56788	AN/VRC-64 Carrier Comd Post								1				1														1
Q56804	AN/VRC-64 Truck Util 1/4-ton	1						1					2														2
Q56805	AN/VRC-64 Truck Util 1-1/4-ton	1											1														1
Q78282	Radio Set Cont Gp: AN/GRA-39		3	2							1		6	1				1									9
Q91302	Radio TTY Set: AN/VSC-3			2									2														2
R29799	Receiver Set Rdo: AN/PRR-9																1	3			9				9	18
U01275	Speech Secure Eq: TSEC/KY-8		2										2														2
U01295	Speech Secure Eq Abn: TSEC/KY-28																		1		10	5	1	1	1	19	19

CAVALRY SQUADRON (DIVISIONAL)

ARMD CAV TRP				AIR CAVALRY TROOP								
Sec	Maint Sec	Armd Cav Plt (3)	Armd Cav Trp Total	Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Sup Sec	Air Cav Trp Total	Armd Cav Sqdn Total
		1	3									9
			2									6
			1		1						1	12
										2	2	2
			5							5	5	25
			1	1							1	5
	2	3	13	2	3	10	6	10	2	33		82
	1		2	1		5	5	5	1		17	28
					1	4	2	3	1	1	12	12
												2
			1									7
												2
			1									3
					1						1	1
2			2									6
												2
										2	2	2
		1	3			3	5	1			9	21
				2		20	10	18	2	2	54	54
			1									5
		1	3									9
												3
	1		1									5
												6
												1
												2
			1									3
	1		2	1	1				1		3	11
					1						1	6
												1
		1	3									9
		1	3									9
	1	1	4									15
												1
												2
												1
			1									9
												2
		1	3			9					9	18
												2
				1		10	5	1	1	1	19	19

QUADRON (DIVISIONAL)

AIR CAVALRY TROOP								
Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Sup Sec	Air Cav Trp Total	Armd Cav Sqdn Total
	2						2	2
		9					9	18
	1						1	1
								10
	2						2	26
3		1		1			5	12
								41
								55
								6
					2		2	2
								1
					1		1	1
					1		1	6
	1				2		3	8
								4
								1
					1		1	6
								4
					1		1	5
					1		1	1
					5		5	5
					1		1	10
								1
								4
								4
								9
								1
	9		2				11	71
								20
								6
								11
	5		1				6	15
								1
	1						1	31
	1						1	5
			5				5	10
								2
	8						8	36
								2

TOE 17-51H)

Line Item No.	Description	QUARTERS TROOP				ARMORED CAVALRY TROOP						TANK COMPANY							
		Redeye Sec	Sqdn Comm Plt	Redeye Tm's (6)	Hq & Hq Troop Total	Hq Sec	Gnd Survl Sec	Maint Sec	Trp Mess Tm	Armd Cav Plt (3)	Armd Cav Trp Total	Hq Sec	Co Mess Tm	Gnd Survl Sec	Maint Sec	Tk Plt (3)	Tk Co Total	Armd Cav Sqdn Total	ACR Total
	ANTENNAS																		
A71438	AT-784/PRC									3	9							27	83
A72260	RC-292		3		6	2					2	2					2	12	42
	RADIAC																		
C74370	Calibrator Radiac																		
E00533	Charger Radiac Detector: PP-1				5						5	3					3	23	81
Q19339	Radiac Set: AN/PDR-27				1										1		1	2	8
Q19750	Radiac Set: AN/PDR-60																		1
Q20935	Radiac Meter: IM-93/UD				13	2		1		5	18	2			2	2	10	77	275
Q21483	Radiac Meter: IM-174/UD				4	1		1		2	8	1			1	1	5	33	123
	RADIO																		
B50868	Beacon Set Radio: AN/GRN-6																		1
H02300	Elec TTY Scty Equip: TSEC/KW-				1													1	6
K93373	Intercomm Set: AN/VIC-1				1					1	3							10	31
L84098	Loudspeaker: LS-454/U				2	1					1							5	16
P84324	Public Address Set: AN/TIQ-2																		2
Q32867	AN/GRC-106, Carrier Comd Po				1	1					1							4	13
Q34312	AN/GRC-160 Mtd Carr Comd &									2	6							18	54
Q34313	AN/GRC-160 Mtd Carr Person						2				2			2			2	8	24
Q34326	AN/GRC-160 Mtd Truck Util 1/-			1	6													6	24
Q38299	AN/PRC-77									1	3							9	37
Q38335	AN/PRC-90				4													4	39
Q45779	AN/VRC-12				3	1				1	4							15	55
Q45797	AN/VRC-12 Mtd Armd Recon A									1	3							9	27
Q45816	AN/VRC-12 Mtd Carrier Pers L																		2
Q45945	AN/VRC-12 Tk Cbt Full Track											2				2	8	8	24
Q50754	AN/VRC-24 Truck 3/4-ton Car																		1
Q53112	AN/VRC-46 Carrier Comd Post		1		4													4	17
Q53223	AN/VRC-46 Carrier Recon FTA									2	6							18	54
Q53556	AN/VRC-46 Recovery Veh FT Li				1				1		1							4	13
Q53741	AN/VRC-46 Tank Recovery Veh				1										1		1	2	6
Q53926	AN/VRC-46 Truck 1/4-ton				4													4	18
Q54037	AN/VRC-46 Truck 3/4-ton Carg				4													4	13
Q54285	AN/VRC-47 Carrier Comd Post				2	1					1							5	18
Q54544	AN/VRC-47 Truck Shop Van																		
Q54618	AN/VRC-47 Truck 1/4-ton				4	1			1		2	1			1		2	12	43
Q54692	AN/VRC-47 Truck 3/4-ton Carg																		1
Q55299	AN/VRC-49 Truck 1/4-ton																	3	9
Q56784	AN/VRC-64 Armd Recon Abn A		3		3													18	54
Q56786	AN/VRC-64 Carrier 107-mm Mo									2	6							9	27
Q56787	AN/VRC-64 Carrier Personnel F									1	3							14	42
Q56788	AN/VRC-64 Carrier Comd Post				1			1		1	4				1		1	1	3
Q56793	AN/VRC-64 Launcher Tank Cha				1													3	9
Q56798	AN/VRC-64 Tank Cbt FT Mdm				3											3	9	9	27
Q56800	AN/VRC-64 Truck 3/4-ton Carg																	1	3
Q56804	AN/VRC-64 Truck Util 1/4-ton				1													2	9
Q78262	Rdo Set Control Gp: AN/GRA-				2													24	81
Q90120	Radio TTY Set: AN/GRC-142			1	7	1					1	4	2				1	5	2
Q91302	Radio TTY Set: AN/VSC-3																		
					2													2	6

CHART B-4 SIGNAL EQUIPMENT AUTHORIZED TO THE ARMORED CAVALRY SQUADRON (DIVISIONAL) (TOE 17-105H)—Continued

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS TROOP													ARMD CAV TRP						AIR CAVALRY TROOP								
		Trp Hq	Sqdn Hq Sec	Sqdn Comm Plt	Sqdn Spt Plt Hq	Sup Sec	Sqdn Maint Plt	Sqdn Med Plt Hq	Aid Sta Sec	Evac Sec	Redeye Sec Hq	Redeye TM's (5)	Hq & Hq Trp Total	Hq Sec	Gnd Survl Sec	Maint Sec	Armd Cav Plt (3)	Armd Cav Trp Total	Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Sup Sec	Air Cav Trp Total	Armd Cav Sqdn Total
U01305	Speech Secure Eq: TSEC/KY-38																			2						2	2
X17820	Transmitter Set Rdo: AN/PRT-4																1	3			9					9	18
Z56480	Rdo Set Con Gp: AN/GRA-74																			1						1	1
K93373	Intercom Set: AN/VIC-1		1										1				1	3									10
	STANO																										
B67423	Binocular Elec: AN/PAS-5		9										9	3		2		5		2						2	26
M35691	Metascope: AN/PAS-6		2			2							4	1				1	3		1		1			5	12
N04593	Night Vision Sight: AN/TVS-2		3			2							5	2	2	2	2	12									41
N04730	Night Vision Sight: AN/PVS-2	4											4	2			5	17									55
Q16110	Radar Set: AN/PPS-5														2			2									6
	TOOLS AND TEST EQUIP																										
D98614	Charger Battery: RA-91																							2		2	2
D99419	Charger Battery: PP-4127/U														1			1									1
K73763	Indicator Channel Alignment: ID-1189/PR																							1		1	1
L00984	Inverter-Vibrator: PP-1703/U			2									2			1		1						1		1	6
M80002	Multimeter: AN/URM-105			2									2			1		1		1				2		3	8
M80242	Multimeter: AN/USM-223			1									1			1		1									4
V74738	Test Set Elec Power: AN/UPM-93			1									1														1
V76108	Test Set Electron Tube: TV-7/U			2									2			1		1						1		1	6
V76519	Test Set Elct Circuit: AN/GRM-55			1									1			1		1									4
V88027	Test Set Radio: AN/VRM-1			1									1			1		1						1		1	5
V99347	Test Set Transponder: AN/APM-123																							1		1	1
W37388	Tool Kit Elec Equip: TK-105/G																							5		5	5
W37483	Tool Kit Elec Equip: TK-101/GSQ			3									3			2		2						1		1	10
W49718	Tool Kit Radar Repair: TK-102/MPS-23			1									1														1
	VISUAL																										
N57705	Panel Set: AP-130-C	1											1	1				1									4
N57842	Panel Set: AP-30-D	1											1	1				1									4
S66941	Searchlight Infrared: AN/VSS-3															3		3									9
	WIRE																										
B07126	Axle Cable Reel: RL-27			1									1														1
C68719	Cable Telephone: WD-1/TT DR-8	4	22	20	4					1			51	3	6		1	3		9		2				11	71
C68993	Cable Telephone: WD-1/TT 2-Cond Fld Wire			20									20														20
R55783	Reel Cable: RL-159/U			6									6														6
R55920	Reel Cable: DR-8			6								1	11														11
R56742	Reel Equip: CE-11																1	3		5		1				6	15
R59023	Reel Machine: RL-31			1									1														1
R59160	Reeling Machine: RL-39		6	4	1						1	1	21	1	2			3		1						1	31
U81707	Switchboard: SB-22/PT			1									1	1				1		1						1	5
V30252	Telephone Set: TA-1/PT											1	5									5				5	10
V30952	Telephone Set: TA-264/PT		2										2														2
V31211	Telephone Set: TA-312/PT	1	3	1	1			1					7	3	4			7		8						8	36
V54548	Terminal Board: TM-184			2									2														2

CHART B-5 SIGNAL EQUIPMENT AUTHORIZED TO THE ARMORED CAVALRY REGIMENT (TOE 17-51H)

Line Item No.	Description	HEADQUARTERS AND HEADQUARTERS TROOP																		AIR CAVALRY TROOP									ARMORED CAV SQUADRON, HEADQUARTERS AND HEADQUARTERS TROOP													ARMORED CAVALRY TROOP						TANK COMPANY							
		Trp Hq	Regt Hq Sec	Comd Veh Sec	Liaison Sec	Comm Plt Hq	Msg Cen and Wire Sec	Radio Sec	Scout Sec	Avn Plt Hq	Comd and Control Sec	Transport Sec	Maint Sec	DS Acft Sys Rep Sec	Med Sec	Redeye Sec Hq	Redeye Tm's (4)	Hq & Hq Troop Total	Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Supply Sec	Air Cav Troop Total	Trp Hq	Sqdn Hq Sec	Sqdn Spt Plt Hq	Trans Sec	Sup Sec	Aviation Sec	Sqdn Maint Plt	Medical Plt Hq	Aid Sta Sec	Evac Sec	AVLB Sec	Redeye Sec	Sqdn Comm Plt	Redeye Tm's (6)	Hq & Hq Troop Total	Hq Sec	Gnd Survl Sec	Maint Sec	Trp Mess Tm	Armd Cav Plt (3)	Armd Cav Trp Total	Hq Sec	Co Mess Tm	Gnd Survl Sec	Maint Sec	Tk Plt (3)	Tk Co Total	Armd Cav Sqdn Total	ACR Total
	ANTENNAS																																																							
A71438	AT-784/PRC								2									2																												3	9								27	83
A72260	RC-292		4					1										5		1						1		3									3		6	2					2	2					2	12	42
	RADIAC																																																					
C74370	Calibrator Radiac		1															1																																					
E00533	Charger Radiac Detector: PP-1578/PD	2																2						5	5	10	4						1							5					5	3					3	23	81
Q19339	Radiac Set: AN/PDR-27		1															1	1							1							1							1										1		1	2	8
Q19750	Radiac Set: AN/PDR-60		1															1																																					1
Q20935	Radiac Meter: IM-93/UD	2	4			2			2									12	2	3	10	6	9	2		32	2	4	2				1	1						13	2		1		5	18	2			2	2	10	77	275
Q21483	Radiac Meter: IM-174/UD	1	2			1			2									6	1		5	1	10	1		18	1		1				2	1						4	1		1		2	8	1			1	1	5	33	123
	RADIO																																																						
B50868	Beacon Set Radio: AN/GRN-6									1								1																																					1
H02300	Elec TTY Scty Equip: TSEC/KW-7		2					1										3										1											1														1	6
K93373	Intercomm Set: AN/VIC-1																			1						1		1											1														10	31
L84098	Loudspeaker: LS-454/U		1															1										1	1										2	1					1								5	16
P84324	Public Address Set: AN/TIQ-2						2											2																																					2
Q32867	AN/GRC-106, Carrier Comd Post Lt Track		1															1										1											1		1					1							4	13
Q34312	AN/GRC-160 Mtd Carr Comd & Recon																																														2	6							18	54
Q34313	AN/GRC-160 Mtd Carr Personnel FTA																																											2					2			2	8	24
Q34326	AN/GRC-160 Mtd Truck Util 1/4-ton								2								1	6																					1	6														6	24
Q38299	AN/PRC-77					1												1			3	5	1			9																		1	3								9	37
Q38335	AN/PRC-90																		1		10	5	9	1	1	27					4								4														4	39
Q45779	AN/VRC-12										4	6						10										3											3	1				1	4								15	55
Q45797	AN/VRC-12 Mtd Armd Recon Abn Veh																																												1	3								9	27
Q45816	AN/VRC-12 Mtd Carrier Pers FTA			2														2																																						2
Q45945	AN/VRC-12 Tk Cbt Full Track 105-mm																																																				2			8	8	24
Q50754	AN/VRC-24 Truck 3/4-ton Cargo									1								1																																						1
Q53112	AN/VRC-46 Carrier Comd Post Lt Track		5															5										3										1	4														4	17
Q53223	AN/VRC-46 Carrier Recon FTA																																												2	6							18	54
Q53556	AN/VRC-46 Recovery Veh FT Light Armd	1																1														1							1					1				1				4	13
Q53741	AN/VRC-46 Tank Recovery Vehicle																															1							1													1	2	6
Q53926	AN/VRC-46 Truck 1/4-ton	2			3					1								6										2		1		1						4													1	4	18
Q54037	AN/VRC-46 Truck 3/4-ton Cargo		1															1										1	1			1	1					4													4	13
Q54285	AN/VRC-47 Carrier Comd Post Lt Track		2					1										3										2									2		1				1								5	18
Q54544	AN/VRC-47 Truck Shop Van									1								1																																					
Q54618	AN/VRC-47 Truck 1/4-ton		3													1		4	1	1				1		3		3							1			4	1			1		2					1		2	12	43
Q54692	AN/VRC-47 Truck 3/4-ton Cargo																			1						1																													1
Q55299	AN/VRC-49 Truck 1/4-ton																																					3		3													3	9
Q56784	AN/VRC-64 Armd Recon Abn Assault Veh																																											2	6							18	54
Q56786	AN/VRC-64 Carrier 107-mm Mortar SP																																											1	3							9	27
Q56787	AN/VRC-64 Carrier Personnel FTA																																	1					1					1	4				1		1	14	42
Q56788	AN/VRC-64 Carrier Comd Post Lt Track																																1						1													1	3
Q56793	AN/VRC-64 Launcher Tank Chassis																																		3				3													3	9
Q56798	AN/VRC-64 Tank Cbt FT Mdm Gun																																																		3	9	9	27
Q56800	AN/VRC-64 Truck 3/4-ton Cargo																										1												1														1	3
Q56804	AN/VRC-64 Truck Util 1/4-ton								2						1			3									1						1						2														2	9
Q78262	Rdo Set Control Gp: AN/GRA-39		5			1		1								1		8		1						1	3	2	1									1	7	1				1	4	2				1	5	24	81
Q90120	Radio TTY Set: AN/GRC-142							1										1		1						1																													2
Q91302	Radio TTY Set: AN/VSC-3		2															2										2											2														2	8

AVALRY REGIMENT (TOE 17-51H)—Continued

RED CAV SQUADRON, HEADQUARTERS AND HEADQUARTERS TROOP														ARMORED CAVALRY TROOP						TANK COMPANY							
Sqdn Hq Sec	Sqdn Spt Plt Hq	Trans Sec	Sup Sec	Aviation Sec	Sqdn Maint Plt	Medical Plt Hq	Aid Sta Sec	Evac Sec	AVLB Sec	Redeye Sec	Sqdn Comm Plt	Redeye Tm's (6)	Hq & Hq Troop Total	Hq Sec	Gnd Survl Sec	Maint Sec	Trp Mess Tm	Armd Cav Plt (3)	Armd Cav Trp Total	Hq Sec	Co Mess Tm	Gnd Survl Sec	Maint Sec	Tk Plt (3)	Tk Co Total	Armd Cav Sqdn Total	ACR Total
																		1	3							9	27
													2													2	9
																		1	3							3	9
			2		2								6							1				1	4	10	46
				2									9	1	2	2		7	26	2		2	2	5	21	108	324
														2				9	29	2					2	89	267
																		1	3							9	27
															2				2			2			2	8	24
																				2				5	17	17	51
													7	3		2	1		6		1		2	5	18	43	132
															1				1			1			1	4	12
													1													1	3
													1										1		1	2	8
					1								7			2			2				1		1	14	59
													1			1			1				1		1	5	16
													1													1	4
													1			1			1				1		1	5	17
																											1
					1								1													1	5
													1													1	9
													1			2			2							7	26
													1													1	3
				1									1													1	5
													1	1					1							4	13
													1	1					1							4	13
																		3	9							27	81
																				2				5	17	17	51
											1		1													1	4
	4									1	20		51	3	6			7	30	10		6		3	25	166	518
											6		6													6	38
											20		20													20	80
											2		2													2	8
																											4
											6		6													6	19
																		1	3							9	34
											1		1													1	5
	1									1	4		12	1	2			1	6	3		2		1	8	38	128
											1		1													1	4
											2		2	1					1	1					1	6	23
																				1		3		1	7	7	30
	1							1			8		17	3	4	1		1	11	3		1			4	54	190

CHART B-6 SIGNAL EQUIPMENT AUTHORIZED TO THE INFANTRY BATTA

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS COMPANY									RIFLE COMPANY					
		Co Hq	Bn Hq Sec	Comm Plt	Spt Plt Hq	Sup Sec	Maint Plt	Med Plt Hq	Evac Sec	Co Total	Hq Sec	Maint Sec	Rifle Plt (3)	Mort Plt	Mort Sqd (3)	Co Total
	ANTENNAS															
A71438	AT-784/PRC			3						3	2					2
A72260	RC-292		3	2						5	2					2
	RADIAC															
E00533	Charger Radiac Detector: PD-1578/PD	4	1							5	3					3
Q19339	Radiac Set: AN/PDR-27							1		1	1					1
Q20935	Radiac Meter: IM-93/UD	2	2	2	2	1	2	2		13	2		2	2		10
Q21483	Radiac Meter: IM-174/PD	1		1	1		1	1		5	2		1	1		6
	RADIO															
E94970	Control Radio Set: C-2299/VRC		1							1						
Q34311	AN/GRC-160 Mtd Carrier 107-mm Mort														1	3
Q34312	AN/GRC-160 Mtd in Carrier Comd & Recon															
Q34313	AN/GRC-160 Mtd in Carrier Personnel													1		1
Q34326	AN/GRC-160 Mtd in 1/4-ton Truck													1		1
Q34327	AN/GRC-160 Mtd in 1-1/4-ton Truck															
Q38299	AN/PRC-77		3			1				4	2		1	3		8
Q45779	AN/VRC-12		2							2						
Q53112	AN/VRC-46 Mtd in Carrier Comd Post		2	1						3						
Q53223	AN/VRC-46 Mtd in Carrier Recon															
Q53556	AN/VRC-46 Mtd in Recovery Vehicle						2			2		1				1
Q53926	AN/VRC-46 Mtd in 1/4-ton Truck		3		1					4						
Q54285	AN/VRC-47 Mtd in Carrier Comd Post		3							3						
Q54322	AN/VRC-47 Mtd in Carrier Personnel										1			1		1
Q54359	AN/VRC-47 Mtd in Carrier Recon										1					1
Q54618	AN/VRC-47 Mtd in 1/4-ton Truck		2							2	1					1
Q55299	AN/VRC-49 Mtd in 1/4-ton Truck			1						1						
Q56787	AN/VRC-64 Mtd in Carrier Personnel								3	3			4			12
Q56788	AN/VRC-64 Mtd in Carrier Comd Post								1	1						
Q56800	AN/VRC-64 Mtd in 3/4-ton Truck															
Q56804	AN/VRC-64 Mtd in 1/4-ton Truck							1		1				1		1
Q78282	Radio Set Control Group: AN/GRA-39		4	2						6	2					2
Q91302	Radio TTY: AN/VSC-3			1						1						
R29799	Receiver Set: AN/PRR-9												6			18
X17820	Transmitter Set: AN/PRT-4												6			18
H02300	Elec TTY Scty Equip: TSEC/KW-7			1						1						
K23746	Headset: H-161/U															
K23814	Headset: H-182/PT													2	1	5
K93373	Intercom: AN/VIC-1		1							1						
L83413	Loudspeaker: LS-166/U		1							1						
U01275	Speech Scty Equip: TSEC/KY-8		2	1						3						
Q53944	AN/VRC-46 Mtd in 1-1/4-ton Truck	1								1						

CHART B-5 SIGNAL EQUIPMENT AUTHORIZED TO THE ARMORED CAVALRY REGIMENT (TOE 17-51H)—Continued

		HEADQUARTERS AND HEADQUARTERS-TROOP																	AIR CAVALRY TROOP								ARMORED CAV SQUADRON, HEADQUARTERS AND HEADQUARTERS TROOP											ARMORED CAVALRY TROOP						TANK COMPANY							
Line Item No.	Description	Trp Hq	Regt Hq Sec	Comd Veh Sec	Liaison Sec	Comm Plt Hq	Msg Cen and Wire Sec	Radio Sec	Scout Sec	Avn Plt Hq	Comd and Control Sec	Transport Sec	Maint Sec	DS Actft Sys Rep Sec	Med Sec	Redeye Sec Hq	Redeye Tm's (4)	Hq & Hq Troop Total	Trp Hq	Flt Op Sec	Aeroscout Plt	Aerorifle Plt	Aeroweapons Plt	Maint Sec	Supply Sec	Air Cav Troop Total	Trp Hq	Sqdn Hq Sec	Sqdn Spt Plt Hq	Trans Sec	Sup Sec	Aviation Sec	Sqdn Maint Plt	Medical Plt Hq	Aid Sta Sec	Evac Sec	AVLB Sec	Redeye Sec	Sqdn Comm Plt	Redeye Tm's (6)	Hq & Hq Troop Total	Hq Sec	Gnd Survl Sec	Maint Sec	Trp Mess Tm	Armd Cav Plt (3)	Armd Cav Trp Total	Hq Sec	Co Mess Tm	Gnd Survl Sec	Maint Sec	Tk Plt (3)	Tk Co Total	Armd Cav Sqdn Total	ACR Total
B29799	Receiver Set Radio: AN/PRR-9																																												1	3							9	27
U01275	Speech Security Equip: TSEC/KY-8		3															3										2											2												2	9
X17820	Transmitter Set Radio: AN/PRT-4																																											1	3							3	9
	STANO																																																					
N35691	Metascope: AN/PAS-6	2																2	5			8	1			14		2			2		2						6						1				1	4	10	46
N04593	Night Vision Sight, Crew Served Wpns AN/TVS-2																										4	3				2						9	1	2	2		7	26	2		2	2	5	21	108	324
N04730	Night Vision Sight, Indiv-Served Wpns AN/PVS-2																																							2					9	29	2				2	89	267
N15518	Observation Device, Night Mdm Range																																											1	3							9	27
Q16110	Radar Set: AN/PPS-5																																							2					2			2			2	8	24
Z42438	Metascope Kit: M60 Tank																																													2				5	17	17	51
B67423	Binocular Elec: AN/PAS-5																		1	2						3		7											7	3		2	1		6		1		2	5	18	43	132
	TOOLS AND TEST EQUIP																																																				
D99419	Charger Battery: PP-4127/U																																							1					1			1			1	4	12
K73763	Indicator Chanel Alignment: ID-1189/PR																																							1												1	3
L00984	Inverter-Vibrator: PP-1703/U							1										1						1		1													1										1		1	2	8
M80002	Multimeter:AN/URM-105							3										3		1				3		4	2					1							7			2			2			1		1	14	59
V76108	Test Set Electron Tube: TV-7/U							1										1																					1			1							1		1	5	16
V76519	Test Set Elct Circuit: AN/GRM-55							1										1																					1													1	4
V88027	Test Set Radio: AN/VRM-1							1										1						1		1													1			1			1				1		1	5	17
W36730	Tool Kit Elec Repairman's: Aircraft													1				1																																				1
W37114	Tool Kit Electrician's: Set No. 2	2																2														1							1												1	5
W37388	Tool Kit Elec Equip: TK-105/G												1					1						5		5													1												1	9
W37483	Tool Kit Elec Equip: TK-101/GSQ							3					1					4						1		1													1			2			2						7	26
V74738	Test Set Elec Power: AN/UPM-93																																							1												1	3
	VISUAL																																																				
L61631	Light Glide Angle Airport Approach									1								1		1						1						1							1													1	5
N57705	Panel Marker Set: AP-30-C	1																1									1											1		1	1					1						4	13
N57842	Panel Marker Set: AP-30-D	1																1									1											1		1	1					1						4	13
S66941	Searchlight Infrared: AN/VSS-3																																																				
S67421	Searchlight Set: Xenon																																																				
	WIRE																																																				
B07126	Axle Cable Reel: RL-27						1											1																				1		1												1	4
C68719	Cable Telephone: WD-1/TT DR-8		5			4		4								1	1	13		5		2				7	4	22	4								1	20		51	3	6			7	30	10		6		3	25	166	518
C68856	Cable Telephone: WD-1/TT RL-159/U						20											20																					6		6												6	38
C68993	Cable Tel: WD-1/TT 2-Cond Fld Wire						20											20																					20		20												20	80
D61303	Case Assy: CY-64/U		2															2																					2		2												2	8
R55783	Reel Cable: RL-159/U						4											4																																					4
R55920	Reel Cable: DR-8																																						6		6												6	19
R56742	Reel Equipment: CE-11						1											1		5		1				6																					1	3					9	34
R59023	Reel Machine Cable Hand: RL-31						2											2																					1		1												1	5
R59160	Reel Machine Cable Hand: RL-39		5			1		1								1	1	12		2						2		6	1							1	4	12	1	2			1	6	3		2		1	8	38	128
U05008	Splicing Kit Tel Cable: MK-356/G																																				1		1												1	4
U81707	Switchboard: SB-22/PT						4											4		1						1											2		2	1				1	6	1		3		1	7	23
V30252	Telephone: TA-1/PT																1	4				5				5																											
V31211	Telephone: TA-312/PT						20											21		7						7	1	6	1					1			8		17	3	4	1		1	11	3		1			4	54	190

CHART B-6 SIGNAL EQUIPMENT AUTHORIZED TO THE INFANTRY BATTALION (MECHANIZED) (TOE 7-45H)

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS COMPANY									RIFLE COMPANY						COMBAT SUPPORT COMPANY											
		Co Hq	Bn Hq Sec	Comm Plt	Spt Plt Hq	Sup Sec	Maint Plt	Med Plt Hq	Evac Sec	Co Total	Hq Sec	Maint Sec	Rifle Plt (3)	Mort Plt	Mort Sqd (3)	Co Total	Hq Sec	Maint Sec	Gnd Surv Sec	Scout Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Antitank Plt Hq	106-mm Sqd (4)	Redeye Sec Hq	Redeye Tm's (5)	Co Total	Bn Total
	ANTENNAS																											
A71438	AT-784/PRC			3						3	2					2					2							2	11
A72260	RC-292		3	2						5	2					2	1							1				2	13
	RADIAC																												
E00533	Charger Radiac Detector: PD-1578/PD	4	1							5	3					3	3											3	27
Q19339	Radiac Set: AN/PDR-27							1		1	1					1	1											1	5
Q20935	Radiac Meter: IM-93/UD	2	2	2	2	1	2	2		13	2		2	2		10	2			2	2	2		1				11	54
Q21483	Radiac Meter: IM-174/PD	1		1	1		1	1		5	2		1	1		6	1				2	1		1				7	30
	RADIO																												
E94970	Control Radio Set: C-2299/VRC		1							1																			1
Q34311	AN/GRC-160 Mtd Carrier 107-mm Mort														1	3							1					4	13
Q34312	AN/GRC-160 Mtd in Carrier Comd & Recon																				2							4	4
Q34313	AN/GRC-160 Mtd in Carrier Personnel													1		1	1											1	4
Q34326	AN/GRC-160 Mtd in 1/4-ton Truck													1		1			4									4	7
Q34327	AN/GRC-160 Mtd in 1-1/4-ton Truck																										1	5	5
Q38299	AN/PRC-77		3			1				4	2		1	3		8	2					3		1				6	34
Q45779	AN/VRC-12		2							2										1								1	3
Q53112	AN/VRC-46 Mtd in Carrier Comd Post		2	1						3																			3
Q53223	AN/VRC-46 Mtd in Carrier Recon																				2							4	4
Q53556	AN/VRC-46 Mtd in Recovery Vehicle						2			2		1				1		1										1	6
Q53926	AN/VRC-46 Mtd in 1/4-ton Truck		3		1					4									1			3			2			12	16
Q54285	AN/VRC-47 Mtd in Carrier Comd Post		3							3												1						1	4
Q54322	AN/VRC-47 Mtd in Carrier Personnel										1			1		1				1								1	4
Q54359	AN/VRC-47 Mtd in Carrier Recon										1					1	1											1	4
Q54618	AN/VRC-47 Mtd in 1/4-ton Truck		2							2	1					1	1					1		1		1		4	9
Q55299	AN/VRC-49 Mtd in 1/4-ton Truck			1						1																			1
Q56787	AN/VRC-64 Mtd in Carrier Personnel								3	3			4			12													39
Q56788	AN/VRC-64 Mtd in Carrier Comd Post								1	1												1						1	2
Q56800	AN/VRC-64 Mtd in 3/4-ton Truck																	1										1	1
Q56804	AN/VRC-64 Mtd in 1/4-ton Truck							1		1				1		1													4
Q78282	Radio Set Control Group: AN/GRA-39		4	2						6	2					2													12
Q91302	Radio TTY: AN/VSC-3			1						1																			1
R29799	Receiver Set: AN/PRR-9												6			18													54
X17820	Transmitter Set: AN/PRT-4												6			18													54
H02300	Elec TTY Scty Equip: TSEC/KW-7			1						1																			1
K23746	Headset: H-161/U																								2			8	8
K23814	Headset: H-182/PT													2	1	5						6						6	21
K93373	Intercom: AN/VIC-1		1							1																			1
L83413	Loudspeaker: LS-166/U		1							1																			1
U01275	Speech Scty Equip: TSEC/KY-8		2	1						3																			3
Q53944	AN/VRC-46 Mtd in 1-1/4-ton Truck	1								1																			1

CHART B-6 SIGNAL EQUIPMENT AUTHORIZED TO THE INFANTRY BATTALION (MECHANIZED) (TOE 7-45H)—Continued

Line Item No.	DESCRIPTION	HEADQUARTERS AND HEADQUARTERS COMPANY									RIFLE COMPANY						COMBAT SUPPORT COMPANY											
		Co Hq	Bn Hq Sec	Comm Plt	Spt Plt Hq	Sup Sec	Maint Plt	Med Plt Hq	Evac Sec	Co Total	Hq Sec	Maint Sec	Rifle Plt (3)	Mort Plt	Mort Sqd (3)	Co Total	Hq Sec	Maint Sec	Gnd Surv Sec	Scout Plt Hq	Scout Sec (2)	Hv Mort Plt Hq	Mort Sqd (4)	Antitank Plt Hq	106-mm Sqd (4)	Redeye Sec Hq	Redeye Tm's (5)	Co Total	Bn Total
	TOOLS AND TEST EQUIP																											
D99419	Charger Battery: PP-4127/U																		5								5	5
F53044	Crystal Set Quartz: CK-32/PR			1						1																		1
F53045	Crystal Set Quartz: CK-33/PR			1						1																		1
F53046	Crystal Set Quartz: CK-34/PR			1						1																		1
F53047	Crystal Set Quartz: CK-35/PR			1						1																		1
K73763	Indicator Channel Align: ID-1189/PR			1						1		1				1		1									1	5
L00984	Inverter Vibrator: PP-1703/U			1						1		1				1		1									1	5
M80002	Multimeter: AN/URM-105			1						1		1				1		1									1	5
V74738	Test Set Elec Power: AN/UPM-93			1						1									1								1	1
V76108	Test Set Electron Tube: TV-7/U			1						1		1				1		1									1	5
V76519	Test Set Elct Circuit: AN/GRM-55			1						1		1				1												4
V88027	Test Set Radio: AN/VRM-1			1						1		1				1		1									1	5
W37388	Tool Kit Elec: TK-105/G																	1									1	1
W37483	Tool Kit Elec: TK-101/GSQ			1						1		1				1		1	1								2	6
Y38404	Wattmeter: AN/URM-98																											
	STANO																											
B67423	Binocular Elec: AN/PAS-5										2	2		1		5	2	2	5			3		1	2	1	1	27	42
M35619	Metascope: AN/PAS-6										1		1	1		5	1			4								5	20
N04593	Night Vision Sight: AN/TVS-2			2			2			4	2	1	4	1	1	19				2	4	1	1		2			23	84
N04730	Night Vision Sight: AN/PVS-2												6			18					4							8	62
N15581	Night Vision Sight: AN/TVS-4													1		1				1		3						4	7
Q16110	Radar Set: AN/PPS-5																		4									4	4
	VISUAL																											
N57705	Panel Set: AP-30-C	14								14																		14
N57842	Panel Set: AP-30-D	1								1																		1
	WIRE																											
B07126	Axle: RL-27			2						2	2					2	2										2	10
C68719	Cable Telephone: WD-1/TT DR-8		6	2	1	1	1			11	4		2	5	1	18	4		4	4	4	8	1	1	2	1	1	47	112
C68856	Cable Telephone: WD-1/TT, RL-159/U			6						6																		6
C68993	Cable Telephone: WD-1/TT, 2-Cond Fld Wire			12						12	8					8	18										18	54
R55783	Reel: RL-159			2						2	7					7	7										7	30
R55920	Reel: DR-8	1								1															2		8	9
R56742	Reel: CE-11										2					2	2			2	4						12	18
R59023	Reeling Machine: RL-31			2						2																		2
R59160	Reeling Machine: RL-39		5	2	1	1	1			10			1	5	1	11			4			2	1			1	1	16	59
R59434	Reeling Machine: RL-172			1						1																		1
U81707	Switchboard: SB-22/PT			2						2	1					1	1					1					2	7
U82529	Switchboard: SB-993													1		1	1					1		1			3	6
V30252	Telephone: TA-1												6	4	1	25												75
V31211	Telephone: TA-312	1	5	2	1	1	1	1		12	2			1		3	2		4	1		6	1	1	2	1	1	32	53